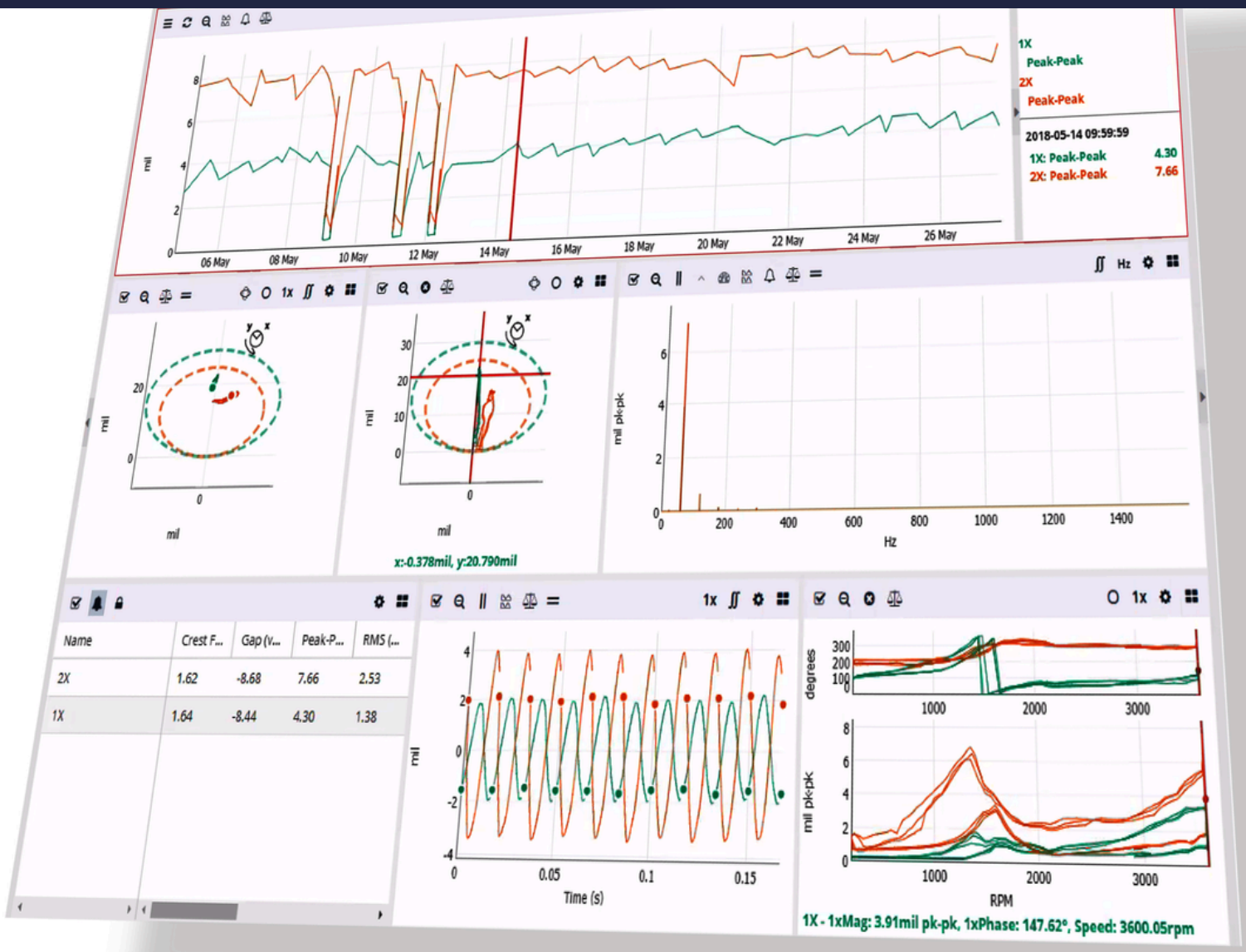
CUTSFORTH

InsightCM™

3.8.0 User Manual



ICM 3.8.0 Rev D

The Power of Innovation

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Please send patent information requests to patents@cutsforth.com.

Safety Information

Safety Information [English]

Following is important safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.

Safety Conventions

NOTE:

Additional information.

ELECTRICAL DANGER

Indicates an action or specific equipment area that can result in personal injury or death from an electrical hazard if proper precautions are not taken.

CAUTION

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury or equipment damage.

WARNING

Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

ROTATING PART CAUTION

Indicates possible injury from rotating parts.

DANGER

Indicates a hazardous situation that, if not avoided, will result in death or serious injury.

General Safety Instructions

ELECTRICAL DANGER

Only qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid injury should work with Cutsforth products. Among the many considerations are the following:

- Avoid contact with energized circuits.
- Avoid contact with rotating parts.
- Never install any component that appears not to be functioning in a normal manner.

ROTATING PART CAUTION

High-voltage and rotating parts can cause serious or fatal injury. Installation, operation, and maintenance of this product must be performed only by qualified personnel, in accordance with all applicable safety regulations and guidelines.

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Consignes de Sécurité [Français]

Les informations qui suivent sont essentielles afin d'assurer la sécurité de l'utilisateur lors de l'installation et de l'opération de l'équipement. Assurez-vous de bien lire et de comprendre tous les avertissements et mises en garde qui suivent.

Conventions de Sécurité

NOTE:

Informations supplémentaires.

RISQUES DE CHOC ÉLECTRIQUE

Indique que l'action ou la partie de l'équipement concernée peut mener à des blessures par électrisation ou à la mort par électrocution si les précautions adéquates ne sont pas prises.

MISE EN GARDE

Indique la présence d'une situation dangereuse qui, si elle n'est pas évitée, pourrait mener à des blessures mineures à modérées ou à des dommages matériels.

AVERTISSEMENT

Indique la présence d'une situation dangereuse qui, si elle n'est pas évitée, pourrait mener à des blessures sévères ou à la mort.

MISE EN GARDE : PIÈCE ROTATIVE

Indique la présence de pièces d'équipement rotatives pouvant causer des blessures.

DANGER

Indique la présence d'une situation dangereuse qui, si elle n'est pas évitée, pourrait mener à des blessures sévères ou à la mort.

Consignes de Sécurité Générales

RISQUES DE CHOC ÉLECTRIQUE

L'utilisation des produits Cutsforth n'est recommandée qu'aux professionnels qualifiés qui savent comment reconnaître la présence de risques de choc électrique ainsi que les consignes de sécurité à suivre pour éviter les blessures liées à ces risques. Lesdites consignes de sécurité incluent, sans s'y limiter :

- Éviter tout contact avec des circuits alimentés;
- Éviter tout contact avec des pièces d'équipement rotatives;
- Ne jamais installer de composante ne paraissant pas fonctionner normalement;

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MISE EN GARDE : PIÈCE ROTATIVE

Les pièces d'équipement rotatives et sous haute tension peuvent causer des blessures sévères ou fatales. L'installation, l'opération et la manutention de ce produit ne doivent être faites que par des professionnels qualifiés et en respectant toutes les règles et consignes de sécurité applicables.

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1. InsightCM 3.8 Introduction

The InsightCM 3.8 Manual contains guidance for setting up new condition monitoring systems in the InsightCM web application, instructions for customizing data collection and maintenance, information on viewing data for analysis, and troubleshooting material.

Top Tasks

What do you want to do?	Where to go
Add and configure assets that monitor your equipment in software.	Configuring Your Asset Tree (page 13)
Map sensors to specific channels on a device and group all sensors for one equipment asset into a data group for which you can configure data collection behaviors.	Adding Cutsforth Monitoring Devices (page 31)
Force an initial acquisition to test whether your system is successfully acquiring data.	Acquiring Data (page 38)
	Acquiring Data for Wireless Devices (page 41)
Configure a trend alarm for an asset.	Configuring a Trend Alarm Rule (page 53)
Review supported data historian.	Historian Software (page 139)

1.1. InsightCM 3.8 New Features

Refer to the list below to learn what's new in InsightCM 3.8.

1.1.1. Air Gap

CMS device images – AirGap-9047 and AirGap-9047 (IEPE Disabled) – now support new air gap assets and two new viewers (page 109) – Pole Profile and Rotor Shape – for hydroelectric air gap analysis.

1.1.2. Fault Frequency Bearings

Select from a customizable database of bearings to add bearing fault frequencies (page 88) to note problematic frequencies in InsightCM.

1.1.3. Optris Thermal Cameras and IR-9055

- Monitor thermal data using newly supported Optris Xi410 thermal cameras (page 42).
- IR-9055 devices support the Optris Xi410 thermal cameras.

1.1.4. Web API Keys

Enable access to InsightCM data services by generating a Web API key (page 129) and providing a Web API key in your HTTP Authorization header (page 130).

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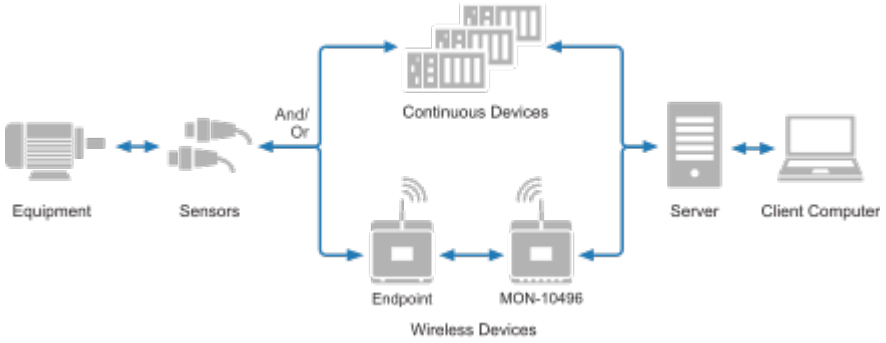
2. Overview of the InsightCM System

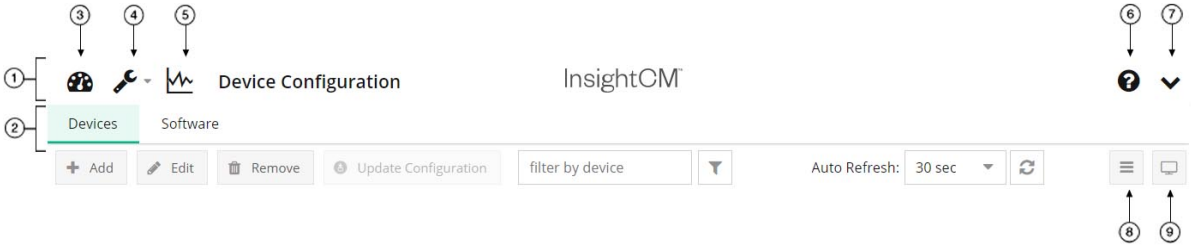
The InsightCM™ Manual refers to various nodes within the order of the InsightCM system. To orient you at any stage during setup, learn the components of the InsightCM system and how each component functions in relation to the others.



System Component	Description
Equipment	The asset whose health you are using the InsightCM System to monitor.
Sensors	InsightCM supports a variety of sensors that collect data from fixed points on your equipment.
Wireless/Continuous Devices	The monitoring devices are used to relay data from the sensors to the InsightCM server.
Server	The server with InsightCM is installed.
Client Computer	The computer uses the InsightCM web application - a browser-based tool for configuring monitoring devices and visualizing data - to access the InsightCM server.

2.1. User Interface Quick Reference

Use the diagram and the terms below to learn how to navigate the web application.



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	Term	Description
①	Navigation bar	Links to pages users require most frequently.
②	Tabs	When present, provides page-specific actions and information.
③	Dashboard page	Contains an overview of the system.
④	Asset and Device Configuration pages	Enables you to configure your assets, sensors, and devices.
⑥	Data Viewer page	Enables you to explore and analyze the data collected from your equipment.
⑥	Help button	Links to help for the current page or tab.
⑦	Navigation menu	Links to additional content not shown in the Navigation bar, such as the Options dialog and System page.
⑧	Action menu	When present, contains additional actions for the current page or tab.
⑨	View menu	When present, links to additional views for a device.

2.2. Setup Process Overview

Setup will generally follow the same order for all new InsightCM systems. Refer to the image below as you set up to ensure that you are addressing all system dependencies.

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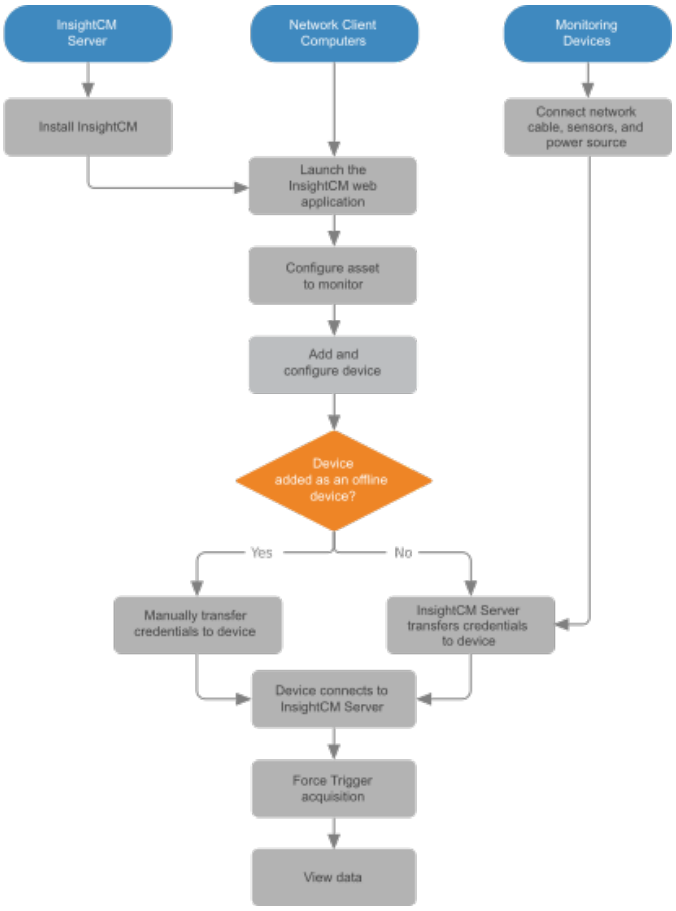

2.3. Glossary

acquisition	The act of a Cutsforth Monitoring System obtaining measurements from sensors connected to device channels.
aging	An automatic process that discards some data files after configurable conditions are met. Aging is useful for conserving space on disk while maintaining a desirable collection of data.
asset	The equipment whose condition you monitor using the InsightCM system.
CompactRIO (cRIO)	The product family to which the controller and chassis in a Cutsforth Monitoring System belongs.
connection information file	A text file that contains connection-related properties, such as a device IP address and credentials. If a device is offline, you can transfer this file to the device via USB drive to bring the device online.
Cutsforth Monitoring System	The CompactRIO-based system, configured via the InsightCM web application, that acquires sensor data, monitors alarms, and more.
data event	An event that leads to the collection of a *data set* or only a *trend point*. Events include alarms, periodic acquisitions, and force triggers.

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data set	Data containing calculated *trend points* and the associated waveform.
Data Viewing page	The page on the InsightCM web application where you can load data acquired from assets or to watch live data streams.
device	The monitoring hardware that receives and sends data from the sensors on the asset to the web application.
device application	Software that runs on Cutsforth Monitoring Devices and causes them to perform operations such as calculating feature values from sensor data. Each device type has a unique application.
device configuration	The collection of properties that controls how a device operates, including how and when it acquires data, from what sensors, and so on. Defined on the Device Configuration page of the InsightCM web application.
device type	The arrangement of I/O modules within the device chassis into a specific pattern. Devices run unique application software according to their device type.
feature	A value calculated from a specific measurement that Cutsforth Monitoring Devices acquire, often for the purpose of trending. For example, RMS is a feature whose value InsightCM Server can calculate from a standard periodic acquisition that occurs for a multiple-second interval.
feature set	A customizable group of features and spectral bands that by default, the InsightCM web application configures all sensors with a sensor type and measurement type to calculate.
firmware	The permanent software on the device that performs lower-level operations than the device application.
high rate feature	For vibration data, this is a feature that the device calculates once per second on each one second data set that the device collects. When you view data in the web application, the server calculates all high rate features on the full file length of data. By default, high rate features are time domain calculations such as RMS and True Peak.
low rate feature	For vibration data, this is a feature that the device calculates based on the file length you set for an operating state. By default, the device calculates low rate features every 4 seconds. Since low rate features are more processor intensive than high rate features, the device only collects and processes data sets for low rate features when the device has enough resources to calculate them. The server calculates low rate features that the device cannot process. When you view data in the web application, the server calculates all features on the full file length of data. By default, low rate features are frequency domain calculations such as 1x Magnitude and 1x Phase.
measurement	A collection of data acquired from an individual sensor by a Cutsforth Monitoring device.
periodic data	Data from any acquisition that is not part of a stream, such as acquisitions triggered by time interval or delta EU settings, an alarm, or a force trigger.

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PI point	A timestamped value stored in the PI System software. InsightCM Server uses the unique name of a PI point to write values to the PI System software.
PI point mapping	The mapping of a source tag in InsightCM Server to the name of a PI point. In other words, InsightCM Server interfaces with PI System points via point mappings.
settings file	See *connection information file*.
spectral band	A spectral band is the calculation of values within a window.
stream	A group of measurements that a Transient, Periodic, and Event Recorder device (CMS-9036) acquires when the equipment it is monitoring enters certain operating states. A stream associates all the acquisitions in one group so you can quickly visualize all the data acquired during a stream-enabled operating state. You can view streams live or playback recorded streams.
system image	See *device application*.
tag	A container that InsightCM Server uses to get and set the value of a specific property. InsightCM Server uses these pre-defined tags to maintain property values for both devices and internal services. Each tag has a unique path, delimited by vertical bars, that identifies it. For example, the `srv|prv|dev|DevNameconfigStatus` tag contains an `OK` and `Error` value.
tracepoint	A flag that, when enabled, instructs InsightCM Server to log messages about when particular events occur. For example, the Storage.MajorOps tracepoint reports about events related to file I/O, such as when InsightCM Server receives a file from a device and saves it.
trend	Values of a feature plotted over time and displayed in the Trend viewer.
trend point	Contains a single point value.

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3. Getting Started

1. Upgrading InsightCM (page 13)—Upgrade the InsightCM software
2. Set up Equipment Assets (page 14)—Configure your asset tree with general and equipment assets that accurately represent and organize the equipment you want to monitor.
3. Add Sensors to Equipment (page 15)—Assign sensor assets to each equipment asset to represent the sensors collecting data from each equipment and to enable features and trend alarm rules.
4. Add a device to InsightCM.

Add a Continuous Device to InsightCM (page 34)	Map a monitoring device that is powered and collects data via wired connection to InsightCM.
Add a Wireless Device to InsightCM (page 40)	Map a monitoring device that collects data wirelessly to InsightCM.
Add a Thermal Imaging Device to InsightCM (page 42)	Map a monitoring device that collects thermal data via ethernet-wired connection to InsightCM.

5. Acquire data from devices.

Acquire Data with Continuous Devices (page 40)	Begin acquiring data from your hardwired devices.
Acquire Data with Wireless Devices (page 41)	Begin acquiring data from your wireless devices.

Both data acquisition methods apply to thermal imaging devices.

3.1. Upgrading InsightCM

Contact Cutsforth Support to upgrade InsightCM.

3.2. Configuring Your Asset Tree

Map your condition-monitoring system on InsightCM using location, equipment, and sensor assets.

1. Organize your assets (page 14)–Use location assets as an organizational element before adding equipment and sensors.
2. Add equipment assets (page 14)–Define the equipment assets in your condition monitoring system on the Asset Configuration page.
3. Add sensor assets to equipment (page 15)–Configure sensor assets for the equipment you are monitoring.
4. (Optional) Add a smart motor pump–Configure equipment on the asset configuration page to populate analysis and alerts in the Reliability dashboard based on your equipment data.
5. Validate your assets (page 15)–Verify that you have configured your assets correctly.

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6. (Optional) Add notes and instructions (page 16)–Add notes and instructions about an asset if multiple people are monitoring it.

Refer to Adding Cutsforth Monitoring Devices (page 31) to configure your monitoring device and/or data source(s) and create data groups (page 47).

3.2.1. Organizing Your Assets

Use location assets as an organizational element before adding equipment and sensors.

Before you begin, determine how you will organize your assets on the Asset Configuration page. For example, you can group assets based on location, the technology you use to monitor your assets, or the structure of a computerized maintenance management system (CMMS).

Add location assets at any level of your asset tree to keep your assets organized.

> Add location assets as child assets for additional levels of organization.

1. Click **Configuration** ( ) and select **Assets**.
2. Above the left-hand asset tree, click **Add**.
3. Expand **General** and select **Location**.
4. Give the location asset a descriptive name and specify how many location assets with this name to add.
5. Click **OK**.
6. Repeat steps 1-5 as needed.

Now begin adding equipment assets (page 14).

3.2.2. Adding Equipment Assets

Define the equipment assets in your condition monitoring system on the Asset Configuration page.

Now that you have set up the organization of your asset tree using location assets, begin adding *equipment assets*, assets that represent your equipment.

1. Click **Configuration** ( ) and select **Assets**.
2. Select a location asset and click **Add**.

   > The equipment options in the dialog box correspond to toolkits you purchased with your InsightCM system.

3. In the resulting dialog box, expand **Equipment** and select an equipment type from the list.

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> Refer to the List of Equipment Asset Types (page 14) to see configuration requirements for each equipment asset type.

4. Give the equipment asset a descriptive name and specify the number assets you want to add to your asset tree.
5. Click **OK**.

Now that you have added your equipment, add sensor assets (page 15) and configure data collection behavior (page 72) using each asset's configuration tabs.

3.2.3. Adding Sensor Assets

Configure sensor assets for the equipment you are monitoring.

Before you begin, add equipment assets (page 14) to the Asset Configuration page.

1. Click **Configuration** ( ).
2. Select an equipment asset that needs sensors.
3. Click **Add** and expand the **Sensors** section.

> For wireless condition-monitoring systems using MON-10411(s), consider using the Wireless Sensor Equipment template. The template automatically populates the correct number of sensors on the asset tree to represent a single MON-10411.

4. Expand the type of device that will monitor your asset and select a sensor.
5. Enter a descriptive name for the sensor asset in the **Name** text field.
6. Specify how many of this asset to add and click **OK**.
7. Repeat steps 2–6 to define additional sensors until you have defined all sensors.

> To configure wireless data collection settings, refer to Configuring Data Collection for Wireless Equipment (page 87).

You have finished constructing your asset tree.

You are ready to add a monitoring device (page 34) and to map device channels to the sensors (page 35) you just added.

3.2.4. Validating Your Assets

Verify that you have configured your assets correctly.

1. Click the **Configuration** button ( ) to navigate to the Asset Confirmation page.
2. Select the asset(s) you want to validate.
3. Click **Validate**. InsightCM displays validation errors if there are any.

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There are no validation errors	A notification saying there are no errors appears. No further action required.
There are validation errors	The Validation Results dialog box appears with a list of validation errors. Take note of the errors, click **OK** , fix the errors, and re-validate until there are no validation errors. InsightCM indicates a valid configuration when the red dot/outline disappears. If still invalid, click **Validate** to identify why your configuration is invalid.

3.2.5. Adding Notes and Instructions About an Asset

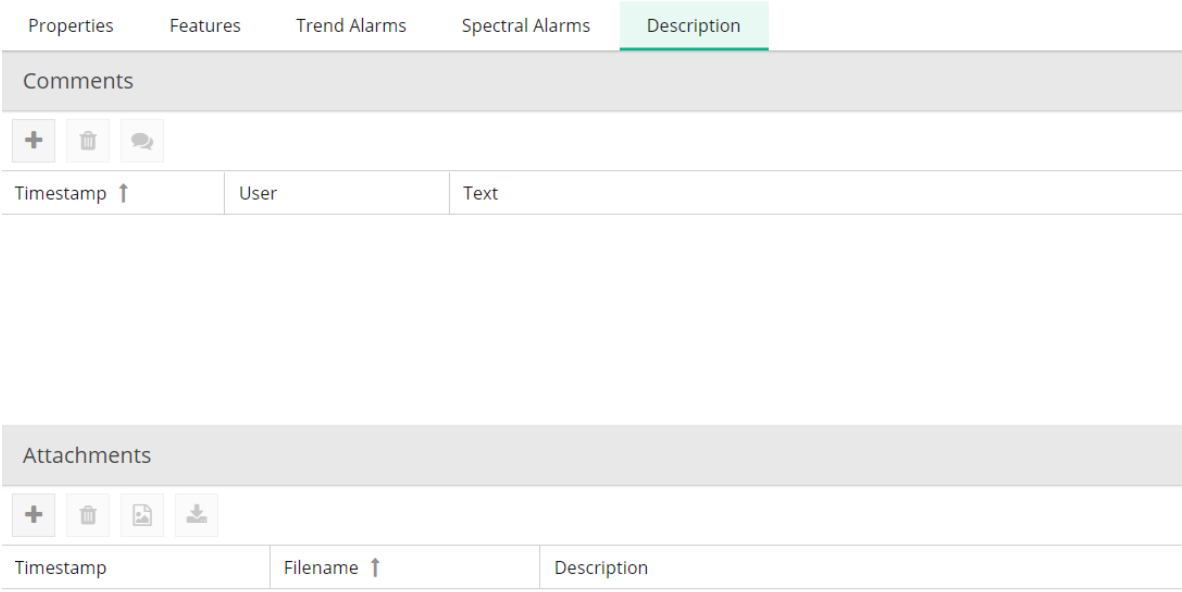
Add notes and instructions about an asset if multiple people are monitoring it.

1. Click **Configuration** ( ) and navigate to the Asset Configuration page.
2. Select an asset and click the **Description** tab in the right-hand asset configuration panel.
3. Click the **Add** button in the Comments toolbar to add a note or specific instruction about the selected asset.

   You cannot edit comments once you add them.

4. Click the **Add** button in the Attachments toolbar to add an attachment relevant to the selected asset.
5. You can add standard notes and attachments to all existing and future assets of a specific type by modifying the **Comments** and **Attachments** section in the **Description** configuration tab on the Asset Definitions page.

   Attachments cannot exceed 10 megabytes.



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3.2.6. List of Features

An important part of the configuration for an asset is the lists of features that InsightCM calculates each time the asset collects data. You can review and configure the list for a given asset on the **Features** tab of the Asset Configuration page.

> You cannot edit pre-configured features - only features that you add to an asset or an asset type.

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Feature Name	Type	Description
Active Power	MCSA	Total input active power, in watts or kilowatts, of the motor
Apparent Power	MCSA	Total input apparent power, in volt-amperes or kilovolt-amperes, of the motor
Average Temperature	Thermal Imaging	The average temperature across an ROI
Crest Factor*	Vibration	$\frac{True\ Pk}{RMS}$
Delta Temperature	Thermal Imaging	The difference between the maximum temperatures of two or more ROIs
Derating Factor	MCSA	The value to derate the motor output based on the calculated motor voltage unbalance in compliance with NEMA MG 1-2014
Derived Peak*	Vibration	$RMS * \sqrt{2}$
Effective Service Factor	MCSA	$\frac{Derating\ Factor}{Load/Full\ Load}$
Efficiency	MCSA	Motor efficiency in percentage
Envelope Total Power	Vibration	The total energy in the envelope spectrum.
Gap	Vibration	The DC value of the signal
Kurtosis	Vibration	$\frac{\mu_4}{\sigma^4}$ Where (μ_4) is the fourth central moment and (σ) is the standard deviation.
Line Frequency	MCSA	Line frequency, in Hz, of the voltage bus
Load	MCSA	Output load, in kilowatts or horsepower, of the motor
Maximum Temperature	Thermal Imaging	The highest temperature across an ROI
MCSA RMS	MCSA	The RMS values of voltage or current waveforms in volts or amperes
MCSA Speed	MCSA	Motor rotational speed in revolutions per minute (RPM)
Minimum Temperature	Thermal Imaging	The lowest temperature across an ROI
Peak-Peak*	Vibration	The greatest positive peak minus the least negative peak
Percent Full Load Amps	MCSA	Maximum RMS for motor startup currents each cycle in percentage of the full load amperes on the motor nameplate
Percent Load	MCSA	Motor load, in percentage of the full load on the motor nameplate
Phasor: Magnitude	MCSA	Magnitude of the fundamental phasor, in volts or amperes, of voltage or current waveforms
Phasor: Phase	MCSA	Phase of the fundamental phasor, in degrees, of voltage or current waveforms
Power Factor	MCSA	Power factor of the motor
Reactive Power	MCSA	Total input reactive power, in volt-ampere reactives or kilovolt-ampere reactives, of the motor

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Feature Name	Type	Description
RMS*	Vibration	The root mean square of the signal
Rotor Bar Sideband	MCSA	Maximum magnitude, in decibels, of rotor bar sideband harmonics. The decibel reference is the fundamental component magnitude in the spectrum
Smax	Vibration	The maximum value of shaft vibration in two dimensions. This feature is available only for displacement sensors that are part of a pair of orthogonal probes. InsightCM Server also requires that each sensor in a pair have the following properties configured on the **Properties** tab of the Asset Configuration page. Otherwise, InsightCM Server logs an error value (-1, by default). ▪ The **Pair Sensor** field must specify the name of the other sensor. ▪ The **Unit** field for each sensor must match. Smax is the result of the following equation, which complies with the ISO 79194:1996(E) standard. $s_{max} = [s_1(t)]_{max} = \left[\sqrt{[s_A(t)]^2 + [s_B(t)]^2}\right]_{max}$ where **S1** is the instantaneous value of the shaft displacement **SA1** is the time-dependent measurement from one sensor in the pair **SB1** is the time-dependent measurement from the other sensor
Startup Peak Amps	MCSA	Maximum instantaneous peak value, in amperes, of startup motor currents
Startup Time	MCSA	Time duration, in seconds, for the motor to remain in startup state
Temperature	Vibration	N/A
Torque	MCSA	Output torque, in Newton meters or pound-foot, of the motor
Torque Ripple	MCSA	$\frac{Torque_{MAX} - Torque_{MIN}}{Torque_{AVG}} \times 100\%$
Total Power in Band	EMSA	The spectral energy in all frequency ranges Use the **Remove Spurs** property for this feature to ensure that feature calculations do not include spikes.
True Peak	Vibration	The absolute value of the greatest positive peak or the least negative peak, whichever is greater
Unbalance	MCSA	Unbalance, in percentage, of three-phase voltage buses or three-phase motor currents in compliance with NEMA MG 1-2014

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Feature Name	Type	Description
*The data is AC-coupled for the purpose of calculating this feature. If a sensor is configured as DC-coupled, the InsightCM Server AC couples its data for the purpose of calculating these features.		

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3.2.6.1. Spectral Bands

Name	Toolkit Required	Additional Explanation
1x Magnitude	Vibration	The sum of the spectrum bins from 0.8x to 1.2x the speed.
2x Magnitude	Vibration	The sum of the spectrum bins from 1.8x to 2.2x the speed.
1x Phase	Vibration	The phase of the 1x component of the signal.
2x Phase	Vibration	The phase of the 2x component of the signal.
Asynchronous	Vibration	The spectral energy that is above 1x running speed and is not synchronous.
EMSA Spectral Band	EMSA	The spectral energy between start and stop frequencies. Use the **Remove Spurs** property for this feature to ensure that feature calculations do not include spikes.
Envelope Spectral Band	Vibration	The sum of energy from the envelope spectrum.
High Frequency	Vibration	The sum of the spectrum bins from 1000 Hz to the maximum frequency value.
Non-synchronous	Vibration	The spectral energy that is not at integer multiples of running speed but is above 1x running speed.
Order Domain Spectral Band	Vibration	The sum of energy from the order spectrum.
Subsynchronous	Vibration	The sum of the spectrum bins from 0.2x to 0.8x the speed.
Synchronous	Vibration	The spectral energy at integer multiples of running speed.
Residual	Vibration	A measure of the energy left in a signal after you remove the energy from all other spectral bands calculated for the sensor. Residual spectral bands apply to a specific domain only, so the InsightCM web application requires you to choose the domain. For example, consider that you assign the acceleration Residual band to a sensor. The value of the band is the energy left after removing the energy from other spectral bands in the acceleration domain only. Therefore, if single integration is enabled, the acceleration Residual band factors in energy removed from a 1x Magnitude spectral band whose units are g rms, but not from a 1x Magnitude spectral band in the velocity domain whose units are ips rms. ▪ You can add one Residual spectral band for each domain to a sensor. ▪ Any phase spectral bands are not part of calculating the Residual spectral band. ▪ If a sensor contains spectral bands that overlap, the algorithm removes the energy from the overlapping region only once. Therefore, the value of residual spectral bands is always greater than or equal to zero. ▪ The residual calculation accounts for the subsynchronous spectral band.
User-Defined	Vibration	The sum of energy from a spectrum where the bands are defined by the user.

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3.2.6.2. Examples of Residual Spectral Band Values

Energy in Signal	Other Spectral Bands	Residual Value
At 1x, 2x, and 3x the running speed	1x Magnitude	All the energy from the 2x and 3x components of the signal.
At 1x, 2x, and 3x the running speed	▪ 1x Magnitude ▪ 2x Magnitude	The energy from the 3x component of the signal.
At 1x, 2x, and 3x the running speed	▪ 1x Magnitude ▪ 2x Magnitude ▪ A custom spectral band for 3x magnitude	Zero
At 1x, 2x, and 3x the running speed	A custom spectral band from 0.8 to 3.2 orders	Zero
At 1x, 2x, and 3x the running speed of 60 Hz	A custom spectral band from 50 Hz to 70 Hz	All the energy from the 2x and 3x components of the signal

3.2.7. List of Asset Properties

On the Asset Configuration page, the Properties tab in an asset's configuration panel contains a subset of these properties. The properties available for a particular asset vary based on the property definition of that asset type.

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Property	Required Toolkit	Description	Additional Information
1x Magnitude Reference	None	The 1x magnitude value when the shaft is at slow-roll speed	On the Data Viewer page, Bode and Polar viewers subtract this slow-roll value from channel data so that the plots start at 0.
1x Phase Reference	None	The 1x phase value when the shaft is at slow-roll speed	On the Data Viewer page, Bode and Polar viewers subtract this slow-roll value from channel data so that the plots start at 0.
B			
Bandwidth (Hz)	EMSA	The amount of data to acquire around a center frequency	N/A
Bearing Clearance Unit	None	The units in which the Horizontal Bearing Clearance and Vertical Bearing Clearance properties express the maximum possible orbit of the shaft centerpoint inside the bearing	N/A
Bearing Start Position	None	The location of the shaft within its bearing housing when at rest, whether at the top, middle, or bottom of the housing	N/A
C			
Calibration Factor	MCSA	The gain factor applied to the voltage or current sensor data	N/A
Coefficient K	CMS	Calculated using the Winter-Kennedy Method Relative Flow Measurement	
Coupling	None	AC or DC	N/A
Current Phase A	MCSA	The current transformer asset node corresponding to phase A of the motor current channels	When only two of the three current phase channels are configured in the **Group Properties** section of the **Properties** tab, InsightCM calculates the data of the third current phase channel.
Current Phase B	MCSA	The current transformer asset node corresponding to phase B of the motor current channels	When only two of the three current phase channels are configured in the **Group Properties** section of the **Properties** tab, InsightCM calculates the data of the third current phase channel.
Current Phase C	MCSA	The current transformer asset node corresponding to phase C of the motor current channels	When only two of the three current phase channels are configured in the **Group Properties** section of the **Properties** tab, InsightCM calculates the data of the third current phase channel.
Custom Coefficients A	None	The A constant of the Callendar-Van Dusen equation	Enter a value for this property when you specify `Custom` for the RTD Type property.

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Property	Required Toolkit	Description	Additional Information
Custom Coefficients B	None	The B constant of the Callendar-Van Dusen equation	Enter a value for this property when you specify `Custom` for the RTD Type property.
Custom Coefficients C	None	The C constant of the Callendar-Van Dusen equation	Enter a value for this property when you specify `Custom` for the RTD Type property.
D			
Detection Mode	EMSA	Determines how amplitude is detected: ▪ Average ▪ Peak ▪ Quasi-Peak	N/A
Detection Time (seconds)	EMSA	The time, in seconds, that a sensor takes to acquire amplitude at a point	N/A
Digital Threshold	None	Specifies what voltage values indicate that the channel is on or off	For example, if you set the digital threshold to 2, values greater than or equal to 2 indicate that the channel is on while values below 2 indicate that the channel is off. The range of valid threshold values is 0-60. This property is only available on the 9219 module.
Double Integration Cutoff	None	The frequency, in Hz, at which to set the highpass filter when performing double integration on asset data	N/A
E			
Efficiency @ 75% Load (%)	MCSA	The motor efficiency as a percentage when the load is three quarters of the full load	N/A
Efficiency @ 50% Load (%)	MCSA	The motor efficiency as a percentage when the load is half of the full load.	N/A
Efficiency @ 25% Load (%)	MCSA	The motor efficiency as a percentage when the load is a quarter of the full load	N/A
Estimate Stator Resistance	MCSA	Whether the motor stator resistance value is manually specified by the user or estimated by the InsightCM Server	InsightCM Server estimates the motor stator resistance based on the motor nameplate parameters. If the motor nameplate information is not appropriately specified, the accuracy of the estimation may be affected, which then affects the accuracy of the motor Torque Ripple and Torque Waveform calculation. The following motor nameplate parameters will affect the stator resistance estimation: Synchronous Speed (RPM), Full Load Speed (RPM), Load, Full Load Efficiency (%), and Full Load Amps (amp).
F			

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Property	Required Toolkit	Description	Additional Information
Full Load Amps (amp)	MCSA	Specify the motor full load current in amperes according to the motor nameplate	N/A
Full Load Efficiency (%)	MCSA	The motor full load efficiency as a percentage according to the motor nameplate	N/A
Full Load Speed (RPM)	MCSA	The motor full load speed in rotations per minute according to the motor nameplate	N/A
Full Scale Voltage	EMSA	The largest voltage range you expect the HFCT to detect	N/A
G			
Gap Voltage Reference	None	The DC value, in volts, of the displacement probe when the shaft is at rest	The Data Viewer page subtracts this value from the DC voltages measured during normal operation and combines the results to generate accurate plots in the Shaft Centerline viewer.
H			
Horizontal Bearing Clearance	None	The horizontal diameter of the maximum bearing clearance, expressed in the units the Bearing Clearance Unit property specifies	The Data Viewer page uses this value to display the maximum bearing clearance line in orbit and Shaft Centerline viewers.
I			
Input Range	None	The input range of the module to which the channel belongs in the same pre-scaled units in which the module acquires data	You can find this value in the module [Operating Instructions and Specifications] document.
IEPE	None	Specifies to power IEPE sensors via the physical connection to the channel. When true, the device also reports open and short conditions for the channel. Set this property to true for IEPE sensors	N/A
L			
Load	MCSA	The motor full load in the unit configured by the Load Unit property according to the motor nameplate	N/A
Load Unit	MCSA	The unit of the motor load from horsepower or kilowatts	N/A
Low Frequency Cutoff	None	The value at or below which InsightCM attenuates frequencies. Attenuation occurs immediately after acquisition and prior to any feature calculations. If you specify a low frequency cutoff value of zero, InsightCM does not attenuate any signal frequencies.	N/A
M			

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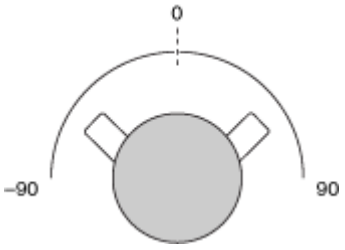
Property	Required Toolkit	Description	Additional Information
Manufacturer	MCSA	The motor manufacturer according to the motor nameplate	N/A
Model	MCSA	The motor model according to the motor nameplate	N/A
N			
Nominal Frequency	MCSA	The nominal frequency of the line power to the motor	N/A
Nominal Line Voltage (volt)	MCSA	The nominal line voltage, in volts, of the voltage bus	N/A
Nominal Speed	None	The theoretical speed if there is no load on the motor	N/A
Number of Intervals	EMSA	The number of sections an EMSA frequency range is divided into	N/A
O			
Offset	None	The y-intercept, [b], of the linear scale ([y] = [mx] + [b]) applied to pre-scaled data	To disable scaling, enter an offset of 0 and a slope of 1.
P			
Pair Sensor	None	The name of another asset to pair with this one for the purpose of generating an orbit plot you can view on the Data Viewer page	N/A
PI Point Name	None	The name of a PI point whose data you want to display on the Data Viewer page. For example, `Unit 1_Motor_Accelerometer Vertical_Crest Factor`	Refer to the Point Mappings Tab on Historian Page (page 145) topic for more information about PI point names.
Power Factor	MCSA	The motor power factor at full load according to the motor nameplate	N/A
Probe Angle	None	The angle in degrees at which the sensor is positioned around the shaft	The following image shows the driver-to-driven perspective of a shaft with two sensors attached. For the sensor that is angled to the right on the shaft, the probe angle is between 0 and 180 degrees. For the sensor that is angled to the left, the probe angle is between 0 and -180 degrees.  Probe angles are independent of

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Property	Required Toolkit	Description	Additional Information
			the shaft rotation direction.
Pulses Per Revolution	None	The number of pulses the tachometer generates per revolution of the shaft. Refer to the sensor documentation to determine this value.	N/A
R			
R0	None	The sensor resistance in ohms at 0 degrees Celsius	The Callendar-Van Dusen equation requires this value. Refer to the sensor documentation to determine this value.
Rated Volts (volt)	MCSA	Specify the motor rated voltage in volts according to the motor nameplate	N/A
Resistance Configuration	None	The number of wires to use for resistive measurements	N/A
Reverse Polarity	None	Enable this control if the polarity of the sensor is reversely wired	N/A
Rotation Direction	None	The direction the shaft turns, whether counterclockwise or clockwise relative to the 12:00 position when you look down the shaft starting from the motor, from the driver-to-driven perspective	N/A
RTD Configuration	None	The number of wires to use for resistive measurements and the typical sensor resistance: ▪ **RTD4W:Pt1000**—Uses the 4-wire resistance method and a platinum RTD with a typical resistance of 1,000 kΩ 0° C. ▪ **RTD4W:Pt100**—Uses the 4-wire resistance method and a platinum RTD with a typical resistance of 100 kΩ 0° C. ▪ **RTD3W:Pt1000**—Uses the 3-wire resistance method and a platinum RTD with a typical resistance of 1,000 kΩ 0° C. ▪ **RTD3W:Pt100**—Uses the 3-wire resistance method and a platinum RTD with a typical resistance of 100 kΩ 0° C.	N/A
RTD Type	None	The type of RTD connected to the asset	If you select **custom**, you must use the three Custom Coefficient properties to supply the coefficients for the Callendar-Van Dusen equation.
S			

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Property	Required Toolkit	Description	Additional Information
Sensitivity (mV/EU)	None	The sensitivity value, in millivolts per engineering unit, taken from the documentation for the connected sensor	N/A
Sensor Ratio	MCSA	The ratio of the sensor converting the raw signal to a lower level signal acquired by C Series voltage or current modules	N/A
Serial Number	MCSA	The motor serial number according to the motor nameplate	N/A
Service Factor	MCSA	The service factor of the motor according to the motor nameplate	N/A
Single Integration Cutoff	None	The frequency, in Hz, at which to set the highpass filter when performing single integration on asset data	N/A
Slope	None	The slope, [m], of the linear scale ([y] = [mx] + [b]) applied to pre-scaled data	For example, a module might acquire data in volts, but that module might be used with a temperature sensor that outputs 100 mV for every 1 °C. You can set this property to 0.01 to implement the conversion from V to °C. To disable scaling, enter an offset of 0 and a slope of 1.
Speed Ratio	None	The ratio of the speed reference value to the asset speed	For example, enter a value of 4:10, if the sensor that the asset maps to is located on a part of the equipment that is spinning 2.5 times faster than the speed reference.
Speed Reference	None	An asset referenced by other assets for the purpose of calculating speed values to correlate with measurement data	N/A
Start Frequency (Hz)	EMSA	The frequency at which the HFCT begins a frequency sweep	N/A
Stator Resistance (ohm)	None	The Stator Resistance in ohms	This option is hidden if you enables the **Estimate Stator Resistance** button. The accuracy of the specified Stator Resistance affects the accuracy of the motor Torque Ripple and Torque Waveform calculation.
Stop Frequency (Hz)	EMSA	The frequency at which the HFCT ends a frequency sweep	N/A
Synchronous Speed (RPM)	MCSA	The synchronous speed in rotations per minute of the motor	N/A
T			
Tachometer Hysteresis (volt)	None	An offset from the Tachometer Threshold that the tachometer signal must cross before the device monitoring the tachometer can detect a new pulse	This value is always positive. For instance, if the Tachometer Threshold (volt) is -5 V, the Tachometer Hysteresis (volt) is 1 V, and the Tachometer Slope is "falling", this

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Property	Required Toolkit	Description	Additional Information
			signal must cross -4 V before the device will detect another pulse.
Tachometer Slope	None	The direction of slopes in the signal, whether rising or falling, that causes the device to measure a pulse when the slopes cross the Tachometer Threshold	N/A
Tachometer Threshold (volt)	None	The unscaled value at which slopes in the signal of the specified direction cause the device to measure a pulse	As an example, if the Sensitivity property for the tachometer channel is 200 mV/EU and a pulse should be detected at 80 mils, this property should be set to 16 V. Tachometer Threshold (volt) = Sensitivity * Tachometer Threshold (scaled). For more information about tachometer-related properties, refer to the Illustration of Tachometer Properties at the bottom of this topic.
Thermocouple Type	None	The type of thermocouple connected to the asset	Thermocouple types, named with letters, differ in composition and measurement range.
Terminal Configuration	None	▪ RSE—Specifies that the analog input assets are referenced single-ended (RSE). A referenced single-ended (RSE) measurement system measures voltage with respect to the ground, which is directly connected to the measurement system ground. ▪ NRSE—Specifies that the analog input assets are non-referenced single-ended (NRSE). In an NRSE measurements system, all measurements are still made with respect to a single-node analog input, AISENSE, but the potential at this node can vary with respect to the measurement system ground. ▪ Differential—Specifies that the analog input assets are differential. A differential measurement system has neither of its inputs tied to a fixed reference, such as earth or building ground. A differential measurement system is similar to a floating signal source in that	N/A

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Property	Required Toolkit	Description	Additional Information
		the measurement is made with respect to a floating ground that is different from the measurement system ground. Handheld, battery-powered instruments and DAQ devices with instrumentation amplifiers are examples of differential measurement systems. This mode measures potential between two inputs and therefore reduces asset count by 2.	
U			
Unit	None	The units in which to measure sensor data on the asset it monitors. For MCSA devices, the units of voltage and current channels match the units of the Voltage and Current asset types on the **Units** tab of the System page. The default unit for voltage channels is volts, and the default unit for current channels is amperes.	The units in which to measure sensor data on the asset it monitors. NA
V			
Vertical Bearing Clearance	None	The vertical diameter of the maximum bearing clearance, expressed in the units the Bearing Clearance Unit property specifies	The Data Viewer page uses this value to display the maximum bearing clearance line in orbit and Shaft Centerline viewers.
Voltage Bus	None	The asset name of the voltage bus to which the motor is connected	N/A
Voltage Phase A	MCSA	The potential transformer asset corresponding to phase A of the voltage bus voltage sensors	When you only configure two of the three phase sensors on the **Properties** tab, InsightCM calculates the data of the third phase sensor.
Voltage Phase B	MCSA	The potential transformer asset corresponding to phase B of the voltage bus voltage sensors	N/A
Voltage Phase C	MCSA	The potential transformer asset corresponding to phase C of the voltage bus voltage sensors	N/A
W			
Wiring Configuration	MCSA	The connection type of the voltage bus sensors	N/A

3.2.7.1. Illustration of Tachometer Properties

In the following illustration, the Tachometer Slope property is set as **Falling**.

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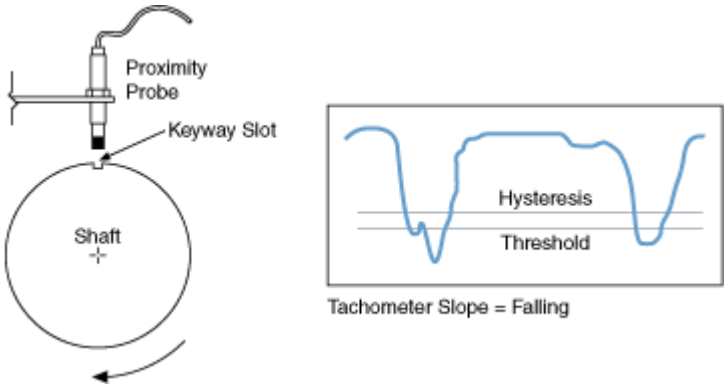

In this example, the signal demonstrates the following behavior.

- The device measures a pulse when the raw voltage signal first falls below the value of the Tachometer Threshold property, as shown in the graph.
- The signal immediately rises above and then falls below the threshold when the keyway slot passes the proximity probe. However, the device does not measure a second pulse because the signal does not also rise above the hysteresis level.

> The hysteresis is useful in this situation because it prevents the noisy signal from triggering a second pulse when it falls below the Tachometer Threshold a second time.

- The signal rises above both the threshold and hysteresis levels, which means the device is able to measure a pulse again when the signal falls below the threshold a third time, near the end of the graph.

3.3. Adding Cutsforth Monitoring Devices

Set up monitoring devices in InsightCM to which the hardware maps.

Before you begin, work with your IT department to retrieve the correct IP addresses for each monitoring device.

Select the type of monitoring devices you are adding to InsightCM and complete the corresponding tasks for each device type below.

Adding Continuous Devices (page 34)	Add a Cutsforth monitoring device that is wired to sensors, the network, and a power source on InsightCM.
Adding Wireless Devices (page 40)	Add a device that communicates wirelessly with endpoints on InsightCM.
Adding Thermal Imaging Devices (page 42)	Add a thermal imaging device on InsightCM.

Now that you have added your Cutsforth monitoring devices, begin customizing your condition monitoring system (page 75).

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3.3.1. Continuous Devices

Familiarize yourself with the following concepts to help you work with Cutsforth monitoring devices that are wired to sensors, the network, and a power source.

For more information regarding module types and compatibility, refer to Continuous Monitoring Device Hardware for InsightCM (page 34).

3.3.1.1. Device Models

Cutsforth Monitoring Devices are available in the following models:

- High-Performance Condition Monitoring Systems—Supports periodic and continuous file collection when equipment enters an operating state of interest, such as a run-up or coast-down. The CMS-9036 is an example of a Transient, Periodic, and Event Recorder system.
- General Purpose Monitoring Systems—Supports periodic file collection when triggered by time or data triggers. The CMS-9065 and CMS-9068 are examples of Periodic and Event Recorder systems.

3.3.1.2. Device Types

When you add a new device, InsightCM requires you to specify the device type. The device type describes the CompactRIO controller and the software application on the device. For example, the CMS-9068 is based on the cRIO-9068 and runs an application designed for monitoring systems.

Each device model has one or more device types that it supports. For example, High Performance Condition Monitoring Systems include device types based on the cRIO-9047 and the cRIO-9036; General Purpose Monitoring Systems include device types based on the cRIO-9068, cRIO-9065, cRIO-9055, and cRIO-9058. Each device runs a different application.

The device type also determines which arrangements of I/O modules within the device chassis are supported.

3.3.1.3. Device Types for High-Performance Condition Monitoring Systems

The application for High-Performance Condition Monitoring device types supports up to eight dynamic C Series I/O modules, such as the Cutsforth 9232. You must fill module slots in ascending order starting with slot 1. You must fill slots 1 and 2. You cannot skip any slots, but you do not have to use every slot.

These device types come in two formats: one that powers IEPE sensors via the physical connection to the channel and one that does not.

3.3.1.4. Device Types for General Purpose Monitoring Systems

InsightCM supports a set of arrangements for static and/or dynamic C Series I/O modules in the chassis. The following table lists the module types you can install under each arrangement, but does not represent all possible valid configurations.

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You do not need to fill every slot, but you must fill slots in ascending order starting at slot 1.

CMS-9068

Chassis Slot Number	Supported Module Arrangements in CMS-9068			
1	Static	Dynamic	Dynamic	Dynamic
2	Static	Dynamic	Dynamic	Dynamic
3	Static	Static	Dynamic	Dynamic
4	Static	Static	Dynamic	Dynamic
5	Static	Static	Dynamic	Dynamic
6	Static	Static	Dynamic	Dynamic
7	Static	Static	Static	Dynamic
8	Static	Static	Static	Dynamic

Chassis Slot Number	Supported Module Arrangements in CMS-9065		
1	Static	Dynamic	Dynamic
2	Static	Dynamic	Dynamic
3	Static	Static	Dynamic
4	Static	Static	Dynamic

3.3.1.5. Guidelines for Chassis with Dynamic Modules

If the arrangement you choose contains any dynamic modules, such as the Cutsforth 9232, install dynamic input modules in adjacent slots beginning with slot 1. You must fill slot 1, but you do not need to fill every slot in the chassis.

3.3.1.6. Guidelines for Chassis with Only Static Modules

For a list of I/O modules that Cutsforth Monitoring Devices support, contact Cutsforth customer support.

3.3.1.7. Types of Software for Devices

Firmware
Cutsforth Monitoring Devices run preinstalled firmware, the permanent software on the device that performs lower-level operations than the device application. You do not directly interact with firmware unless you receive an updated or patched version. Use the Package Management page to upload the firmware so you can apply it to devices. Then, use the Software tab on the Device Configuration page to update the firmware on a device to the new version.

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Applications for Devices
The Software tab on the Device Configuration page displays an overview of the application types and versions running on each device. Update device applications to the latest version and reset the firmware to the preinstalled version from the Software tab. You do not directly interact with the application unless you receive an updated or patched version. Use the Package Management page to upload the application so you can apply it to devices. The Package Management page refers to applications as system images.

Device Configurations
A *device configuration* is a collection of properties that controls how a device operates, including how and when it acquires data and collects files. Define the configuration for a device on its Device Configuration page in InsightCM. Click **Update Configuration** at the top of the Device Configuration page each time you make a change to a device's configuration to send the updated configuration to the device. The device might require several minutes after the last time you click Save to download the configuration and come online again.

3.3.1.8. Adding a Continuous Device

Add and configure a Cutsforth monitoring device that is wired to sensors, the network, and a power source.

Before you begin, configure assets (page 14) on the Asset Configuration page.

1. Click the **Configuration** pull-down ( ) and select **Devices**.
2. Click **Add**.
3. In the **New Device** dialog box, connect to an online or offline device.

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Option	Description
Connect to an online device	1. Select **Connect to an online device** and enter the IP address in the textbox. If you do not know the device IP address, click **Browse** to see a list of devices on the same subnet as the server machine. 2. To check for common problems that prevent a device from connecting to InsightCM and coming online, click the **Connect** button. The web application opens the **Test Connection** dialog box and checks for problems. If the check fails, this dialog box provides troubleshooting information. You can continue to add an online device without resolving failed checks if the device passes the IP address check. 3. Click **OK**. 4. Select your device type from the **Device Type** pull-down menu. 5. Configure the slots to match the module configuration on your physical device. If you need to update the module configuration in InsightCM at a later time, navigate to the **Hardware** tab of the specific device's configuration page. 6. Click **Next**. 7. Enter the following names for the device. ▪ **Device Name**—The name you want to appear throughout the web application. Assign an easily identifiable name, such as one that indicates the physical device location or the equipment it monitors. ▪ **Hardware Name**—The hostname of the device, which is in the format of `NI-cRIO-ModelNumber-SerialNumber` by default. If the device is online, InsightCM automatically populates this name. Otherwise, find the two values printed on a label on the back of the device.
Connect to an offline device	1. Select **Create an offline device** option and click **Next**. 2. Select your device type from the **Device Type** pull-down menu. 3. Configure the slots to match the module configuration on your physical device. If you need to update the module configuration in the web application at a later time, navigate to the **Hardware** tab of the specific device's configuration page. 4. Click **Next**. 5. Enter a descriptive name in the **Device Name** text field. 6. Once you have added an offline device, transfer a connection file to your offline device (page 37).

4. Click **Finish** to add your device to the server.

Now that you have added continuous monitoring devices, map device channels and data groups (page 35).

3.3.1.9. Mapping Channels and Data Groups

Map sensors to device channels and group all sensors for an equipment asset into a data group. You can configure data collection behaviors for each data group.

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Ensure that you have added at least one equipment asset (page 14) with sensor assets on the Asset Configuration page.

Data groups enable you to organize data from device channels monitoring the same equipment into one data event. Since each equipment asset has a defined set of operating states, create one data group per equipment asset.

1. Click the **Configuration** pull down ( ) and select **Devices**.
2. Double-click the device whose channels you want to map.

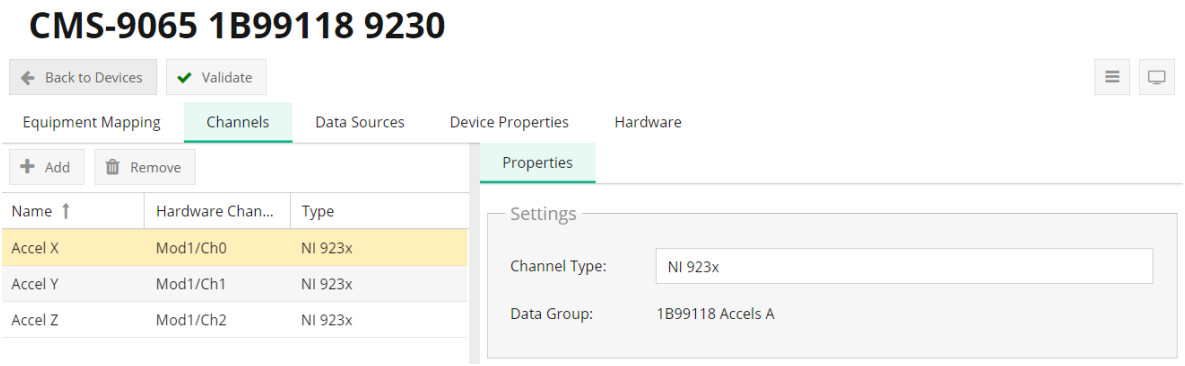
   For wireless and thermal imaging devices, add wireless sensor endpoints (page 40) and/or discover ROI cameras (page 42) directly from the device's configuration page to enable devices to collect data.

3. Select the **Equipment Mapping** tab and click **Add/Remove**.
4. Click **Add**, select the equipment level asset, and click **OK**.

   If you remove the Default data group from this section, your device channels will automatically be reassigned to the data group you added.

   You created a new data group.

5. Click the **Channels** tab and select one of the channels.
6. Click **Select Data Group** and select the new data group from the pull-down.
7. Once you assign the data group to your channels, select a channel and select a sensor in the right-hand asset tree to map a channel to a sensor asset.



8. Repeat steps 4–5 until you have mapped each of the sensors to a channel.

   Not all device channels need to have a sensor mapped to them.

9. (Optional) Add additional data groups to the device if you are mapping remaining channels to sensor assets associated with different equipment.
10. Above the Equipment Mapping tab, click **Validate**.

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> InsightCM removes unmapped channels when you click **Validate**. Use the **Channels** tab to add channels back to the Channels table as needed.

11. Above the device's configuration tabs, click **Back to Devices**.
12. Select the device whose channels you configured and click **Update Configuration** under the Devices tab.

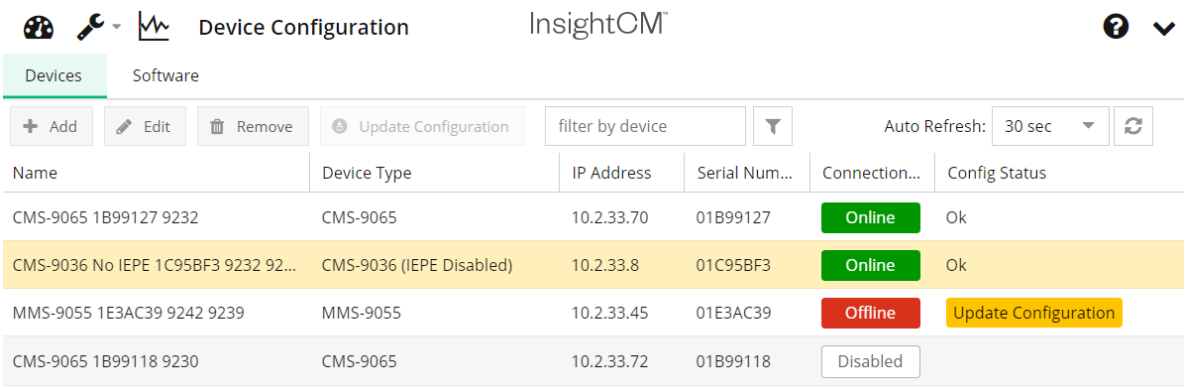
> Any changes you make on the Device Configuration page or the Asset Configuration page will not be applied until you click **Update Configuration**.

3.3.1.10. Verifying Device Connectivity

After you send the connection information to the device, it automatically connects to the server.

Complete the following steps to verify that the device connects successfully.

1. In the web application, click the **Configuration** pull-down ( ) and select **Devices**.



2. On the **Devices** tab, verify that the Connection Status column for the device says Online, which means the device finished updated and connected successfully to the server.

> The device might require several minutes to download configuration files and reboot before it connects to the server and comes online. During this time, the device status might change multiple times. Click the **Refresh** button to see the latest status.

3.3.1.11. Transferring a Connection File to an Offline Device

Connect your offline device to the InsightCM Server by transferring a connection file to the device.

If you added the device configuration without entering the IP address, the device cannot yet connect to InsightCM because it does not have the information needed to connect to the server. Complete the following steps to transfer credentials to the device.

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1. Click the **Configuration** pull-down ( ) and select **Devices**.
2. Find the device connection file you exported when you added a device to the InsightCM Server.
3. If you did not export a connection file, return to the Device Configuration page.
   1. Select the device.
   2. Select the **Action** menu ( ) and hover over **Connection**.
   3. Select **Export Connection File**.
4. Copy the file to a USB drive folder named **upload** in the following directory: `<RootLevel>:\InsightCM`.

   If the **upload** folder does not exist, create it.

   The filename must be in the format of **DeviceHostname-SerialNumber.json** or the device will not read it.
5. Insert the USB into the USB port on the controller front panel and note that the USER1 LED light will switch from blinking to solid when the device is reading the connection file.
6. When the USER1 LED returns to blinking steadily, remove the USB drive.
7. From the Device Configuration page, select the device to which you manually transferred a connection file, click the **Action** menu ( ) and select **Reboot**.

3.3.1.12. Acquiring Data

When the device is online with all relevant channels mapped to sensors, test your device's ability to acquire data. Automatic acquisitions occur periodically, but you can force an acquisition at any time using Force Trigger.

Complete the following steps to test whether or not the channels in your device can acquire data.

1. Click the **Configuration** pull-down ( ) and select **Devices**.
2. On the **Devices** tab, select the device you added.
3. In the **Action** ( ) menu, select **Force Trigger** to perform an acquisition from all channels.
4. (Optional) Click the **Layout** ( ) button on the viewer toolbar, hover over **Chart Type**, and select **Thermal Image** to change the viewer to one that can view thermal imaging data.
5. Wait several seconds for the acquisition to be complete before clicking the **Data Viewer** ( ) button to view the Data Viewer page. Click on a feature level asset for the equipment and confirm that data has been acquired.

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> Before data is available, devices must finish performing the acquisition and the InsightCM server must receive and store the data. The duration of a force-triggered acquisition is based on the file length of the equipment's Default operating state (page 62).

6. Repeat the force acquisition several times to acquire multiple data sets.

3.3.2. Wireless Gateways and Devices

Wireless gateways, wireless monitoring devices, and wireless vibration sensors eliminate the need for extensive wiring by using wireless technology to transmit equipment data to the InsightCM server for analysis while maintaining high levels of data acquisition.

3.3.2.1. Wireless Monitoring Gateways

A *MON-10496* is a wireless gateway device that sends data to the server and receives data from endpoints. *Endpoints* are wireless devices and wireless sensors that communicate data to the MON-10496.

> Environmental factors—such as physical obstruction and severe weather—can affect the performance of the wireless gateway and wireless monitoring device. Configurable factors—such as frequency and size of data collections—can also affect the performance of the wireless monitoring gateway, the wireless device, and the wireless sensor.

The endpoint is configured from the MON-10496's Device Configuration page and is added with an association to an equipment asset.

3.3.2.2. Wireless Vibration Measurement Devices

A *MON-10467* is a wireless vibration measurement device that sends data wirelessly to the MON-10496 and can be configured with the following sensors:

- Accelerometer
- Displacement
- Tachometer
- Velocity
- Static voltage

3.3.2.3. Wireless Vibration Sensors

A *MON-10411* is a wireless vibration sensor that sends data wirelessly to the MON-10496 and has the following built-in sensors:

- Three Accelerometers
- Wireless Temperature

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3.3.2.4. Adding Wireless Monitoring Devices and Endpoints

Add a wireless monitoring device and an endpoint to the InsightCM server.

1. Click the **Configuration** pull-down ( ) and select **Devices**.
2. Click the **Add** button.
3. In the **New Device** dialog box, you can add a device in two ways.

Option	Description
Connect to an online device	1. If you do not know the IP address of your device but it is online, select **Connect to an online device** and click **Browse** to see a list of devices on the same subnet as the server machine. 2. Select a device from the **Subnet Devices** dialog box and click **OK**. 3. Click **Connect** and the web application will automatically perform tests to verify the device IP address, firmware, connection, and hardware. ▪ In the **Testing Connection** dialog box, you can see the results of testing and information about how to resolve any issues. ▪ You can continue to add an online device without resolving failed checks if the device passes the IP address check. 4. Click **OK**. 5. Select the wireless device type from the **Device Type** pull-down. 6. Configure the slots as needed to match the module configuration on your physical device. 7. Click **Next**. 8. Give the device a descriptive name in the **Device Name** text field.
Connect to an offline device	1. If your device is offline, ensure that the **Connect to an offline device** option is selected and click **Next**. 2. Select your device type from the **Device Type** pull-down. 3. Configure the slots as needed to match the module configuration on your physical device. If you need to update the module configuration in the web application at a later time, navigate to the **Hardware** tab of the specific device's configuration page. 4. Click **Next**. 5. Give the device a descriptive name in the **Device Name** text field. 6. Once you have added an offline device, transfer a connection file to your offline device (page 37).

4. Click **OK** and you will be automatically redirected to the **Endpoints** tab of the wireless monitoring device's configuration page.
5. Click **Add** pull-down menu and select **Offline** to add the endpoint as an offline device.

   If the endpoint is powered and within range of the wireless monitoring device, click **Add** to have your wireless monitoring device discover the endpoint.

6. Enter the serial number of your endpoint, designate the endpoint type as **Wireless Sensor** for a MON-10411 or **Wireless Device** for a MON-10467, and click **OK**.

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7. In the Select Wireless Equipment dialog box, select a wireless equipment asset to associate the wireless device endpoint with and click **OK** to add your endpoint.

> To change the asset endpoint associates with, be sure to remove the endpoint from its current asset before adding it to the new one.

8. Use the pull-down under Channel in the Endpoint configuration panel to assign which channels from the wireless gateway correspond to each sensor associated with the equipment.

> If you have added more than one endpoint, you may need to resolve the collection time schedule by clicking **Schedule** and then **Resolve All**. If you do not resolve the collection time, wireless endpoints will spend additional time communicating with the gateway, which decreases endpoint battery life.

Now you have successfully added a wireless monitoring device and an endpoint to your InsightCM server. Wireless devices default to having one collection time. You can reconfigure collection time in the Collection tab of the wireless equipment's configuration panel.

3.3.2.5. Acquiring Data for Wireless Devices

When the wireless gateway is online with all endpoints mapped to sensor assets, you can test your wireless device's ability to acquire data. Automatic acquisitions occur periodically, but you can force an acquisition at any time by using Force Trigger.

Complete the following steps to acquire data from one of your endpoints.

> Acquiring data from all of a device's endpoints can create network congestion.

1. Click the **Data Viewer** ( ) button.
2. Expand one of the wirelessly monitored equipment assets, select a sensor asset, and then select one of the features. By selecting a feature, you activate the Trend viewer chart.
3. In the Trend viewer chart, click the **Action** menu ( ) and select **Force Trigger** to acquire data from the endpoint mapped to this equipment asset.
4. Wait several seconds for the acquisition to complete and click the **Refresh** button to confirm that your device received new data points.

> If you force an acquisition for all endpoints, it could take several minutes for the wireless gateway to complete the acquisition.

5. Repeat the force acquisition several times to acquire multiple data sets.

> Before the data is available, devices must finish performing the acquisition and the InsightCM server must receive and store the data. You can change the duration of force-triggered acquisitions on the **Operating States** tab for the equipment being monitored on the Asset Configuration page.

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For a complete list of ways you can configure a device to perform acquisitions, refer to Methods for Initiating Device Acquisitions (page 40).

3.3.3. Thermal Imaging Device Types

Using thermal cameras, monitor thermal data in a large area without extensive wiring to thermocouples.

Device Type	Compatible Camera(s)	Sensor Asset Type	Description
IR-3120[1]	FLIR A35, FLIR A65	Delta, ROI	Supports up to two thermal cameras. See the IC-3120 help for more information.
IR-9055[2]	Xi410	Delta, ROI	Supports up to ten thermal cameras. See the cRIO-9055 help for more information.

[1]Connects directly to the device controller by ethernet connection, not by channels on a module.

[2]Connects to the device through a Power over Ethernet (PoE) adapter, not by channels on a module.

3.3.3.1. Adding a Thermal Imaging Device

Add a thermal imaging device to collect temperature data from thermal cameras.

1. Click **Configuration** ( ) and select **Devices**.
2. In the **Devices** tab, click **Add**.
3. Select **Connect to an online device** and enter the IP address in the textbox.

   > If you do not know the device IP address, click **Browse** to see a list of devices on the same subnet as the server machine.

4. Click the **Connect** button. The **Test Connection** dialog box prompts you if the device fails to connect to the server machine and come online. Resolve all failures before continuing.
5. Click **Next**.
6. If the device passes all connection tests, the web application detects and displays the controller. Click **Next**.
7. Enter the two types of names for the device.
   a. **Device Name**—The name that will appear throughout the web application.

      > Assign your device an easily identifiable name, such as one that includes the device location.

   b. **Hardware Name**—The hostname of the device, which is in the format of `NI-IC-ModelNumber-SerialNumber` by default. If the device is online, the server automatically populates this name. Otherwise, you can find the two values printed on a label on the back of the device.
8. Click **Finish**.

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9. When the web application prompts you to send the connection information to the device web server, click **Yes**.

Discover your FLIR (page 43) or Optris (page 46) cameras.

3.3.3.2. Discovering FLIR Cameras

Discover and add the FLIR A35 and/or FLIR A65 cameras you will use to monitor your equipment's thermal data.

Ensure that you have completed the steps in Adding a Thermal Imaging Device (page 42) and that you have the serial number for each camera you intend to add.

1. Click **Configuration** ( ) and select **Devices**.
2. On the **Devices** tab, double-click the device to which the camera(s) connect.

   Cameras are connected and also powered through their connection to the device.

3. On the **Cameras** tab, click **Add**.
4. In the **Add Cameras** dialog box, click **Discover** and the serial numbers of all valid cameras connected to the device appear in the table.
5. Select the cameras you want to add and click **Apply**.
6. When prompted, enter a descriptive name for each camera and click **OK**.

   Allow several minutes after you add a thermal imaging device before attempting to discover cameras.

Add regions of interest (page 46) and configure temperature deltas (page 47).

3.3.3.3. Preparing Optris Cameras for Discovery

Set up the Xi410 Optris cameras you will use to monitor your equipment's thermal data before you add and configure them on InsightCM.

Before you begin, ensure the computer you use for the initial camera setup is compatible with PIX Connect software and you can change the network settings securely.

1. Install and launch the latest version of PIX Connect software as an administrator.
2. Connect the Xi410 camera to the computer using the provided USB cable.

   Cutsforth recommends setting up one camera at a time.

3. Click **Devices** and verify that PIX Connect recognizes the camera.

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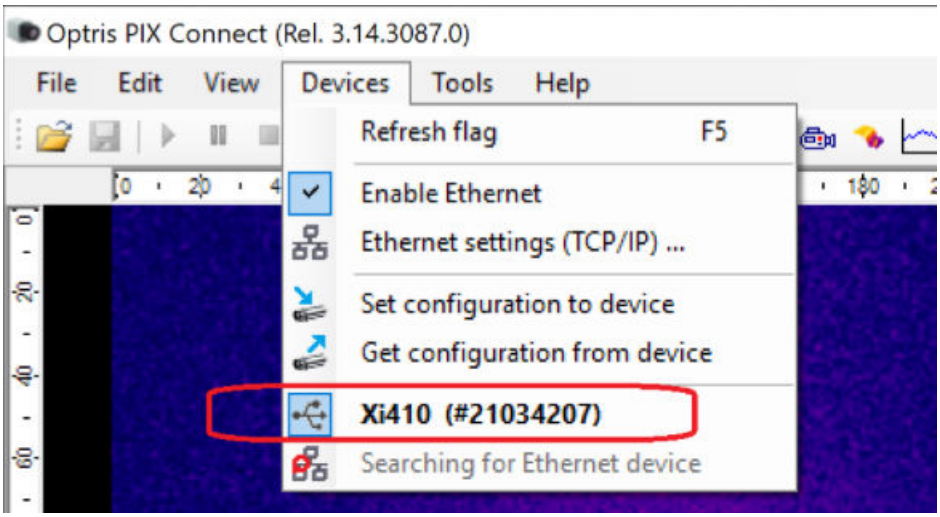

4. Click **Help > About** and verify that the Imager Firmware version on the camera is at least 3814 or newer.

Imager Firmware version is older than 3814	1. Click Tools → Extended → Update Firmware. 2. Deploy the latest firmware to the camera from PIX Connect. 3. Click Help → About to confirm the firmware update. 4. Click **Close**.
Imager Firmware version is 3814 or newer	Click **Close**.

5. Click **Devices > Ethernet Settings**.
6. Set **Device Address** to **192.168.0.101**.

> If multiple Optris cameras will be connected to the same thermal imaging device, increment the last digit of the IP address for each successive camera.

7. Set **Send to address** to **192.168.0.100**.
8. Set **Subnet Mask** to **255.255.255.0**.
9. Set **Port** to **50000**.

> If multiple Optris cameras will be connected to the same thermal imaging device, increment the final digit of the port number for each successive camera.

10. Disable the **Auto assign port number** checkbox to better track what data is coming from which camera.
11. Set **Listen on port number** to **50000** (or—if another camera—to the same port number you assigned to this camera).
12. Click **OK**.
13. Click **Tools > Configuration**.
14. On the **Device** tab, input a Temperature Range.
15. On the **External Communication** tab, select the **Enable** checkbox under **Direct temperature mode**.

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> Temperature values will not be correct unless you enable this checkbox.

16. Click **OK**.
17. Click **Devices > Set configuration to device** to push your configuration settings to the camera. Once the progress bar at the bottom of the window is complete, you have successfully configured your Optris camera.
18. Disconnect and set aside the USB cable.
19. Connect the camera to the Power over Ethernet (PoE) adapter.
20. Using an ethernet cable, connect the PoE adapter to the PoE Switch.
21. Using another ethernet cable, connect the PoE Switch to the computer.
22. On the computer, navigate to **View network computers and devices** in File Explorer.
23. Select **Network and Sharing Center**.
24. Click **Change adaptor options**.
25. Set up your ethernet port for a connection test with the Optris camera.
    a. Select the Ethernet port that is connected to your Optris camera and click **Change settings of this connection > Properties**.
    b. Select **Internet Protocol Version 4 (TCP/IPv4) > Properties**.
    c. Select **Use the following IP address**.

    > After you successfully test the camera ethernet connection, revert this setting so that your ethernet port resumes obtaining IP addresses automatically.

    d. Set **IP address** to **192.168.0.100**.
    e. Set **Subnet mask** to **255.255.255.0**.
26. Test the ethernet connection to the Optris camera.
    a. Launch PIX Connect.
    b. Click **Devices** and select the Optris camera you want to test.
    c. Select the **Connect** checkbox and verify that the UDP Port number is **50000**.

    > If you change the port number between when you configured it during initial camera setup, you have to re-enter the correct port number each time you launch the software.

    As a result, your operating system firewall may request permission to communicate.

    d. Select **Private networks** and **Public networks** and click **Allow access**.

    > If you are unable to see an image from the camera, you may need to disable the Windows Firewall until you complete this test. If you disable the Windows Firewall, ensure that your computer is not connected to an open network while the firewall is disabled.

    e. Confirm that the **direct temperature mode** checkbox is enabled.

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f. Click **Tools > Configuration > External Communication**.

g. Confirm that a live image from the camera shows on the computer and that the Connected to IP address matches the one you set for the Optris camera during setup.

> The corners of the live image should say Temperature Mode.

27. Close PIX Connect and disconnect the PoE switch from the computer.
28. Using an ethernet cable, connect the PoE Switch to the secondary ethernet port on the IR-9055.

Configure your thermal imaging device (page 42) and sensors (page 46) in InsightCM.

3.3.3.4. Discovering Optris Cameras

Discover and configure the Xi410 Optris cameras on InsightCM.

Before you begin, complete the set-up process (page 43) for the Optris cameras and add a thermal imaging device (page 42). Have your camera IP address(es) and port number(s) ready.

1. Click **Configuration** ( ) and select **Devices**.
2. On the **Devices** tab, double-click the device to which the camera(s) connect.

> The camera's device connection both powers the device and carries the signal.

3. On the **Cameras** tab, click **Add**.
4. In the **Add Cameras** dialog box, click **Discover** and the IP addresses and port numbers of all valid cameras connected to the device appear in the table.
5. Select the cameras you want to add and click **Apply**.
6. When prompted, enter a descriptive name for each camera and click **OK**.

> Allow several minutes after you add a thermal imaging device before attempting to discover cameras.

Add regions of interest (page 46) configure temperature deltas (page 47)

3.3.3.5. Adding and Mapping Regions of Interest

Define the section of a camera image that you want to monitor for thermal data.

Complete the following steps to define a Region of Interest (ROI) to monitor using your thermal imaging camera and device.

1. Click the **Configuration** pull-down ( ) and select **Devices**.
2. In the list of devices on the **Devices** tab, double-click the device connected to the camera for which you want to define an ROI.

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3. On the **Cameras** tab, select the camera that monitors the equipment for thermal data and click **Manage ROIs**.
4. In the **[Camera Name] ROIs** dialog box, click **Add**.
5. In the **New ROI** dialog box, select the piece of equipment the camera is monitoring.
6. In the box at the bottom of the **New ROI** dialog box, enter a descriptive name for the ROI and click **OK**.
7. In the ROIs dialog box, click the **Capture Image** button.

> If you added your camera as an offline device, but captured an image that you took from the device prior to connecting it to InsightCM, you may upload it as a JSON file and identify ROIs using the uploaded image.

8. Use the **Rectangle ROI** or **Polygon ROI** button to draw an ROI on the captured image.

> You can use the arrow buttons along the side of the image to nudge the ROI if the position of the camera shifts.

9. Without capturing a new image each time, repeat Steps 2–7 until you have added all your ROIs.
10. Click **Close** when you are finished adding ROIs.

3.3.3.6. Configuring Temperature Deltas

Deltas measure the difference between two ROIs that have the largest temperature difference in a group of two or more ROIs. The delta is calculated by subtracting the lowest maximum temperature from the highest maximum temperature of a set of ROIs selected. You can set alarm conditions on deltas to monitor when the difference between ROI temperatures exceeds the value you specify.

Complete the following steps to configure an ROI Delta.

1. Click the **Configuration** ( ) button and ensure that you are on the **Asset Configuration** page.
2. In the asset tree, select the piece of equipment that contains the ROIs for which you want to configure a delta.
3. Click **Add** and select **Sensors** » **Thermal Imaging** » **Delta** in the New Asset dialog box.
4. Enter a descriptive name for the delta and click **OK**.
5. On the **Properties** tab for the new ROI delta, click the **Edit** button next to the **Camera** field.
6. In the **Camera** dialog box, select the camera containing the ROIs you want to configure a delta for, click **OK** and a new row for ROIs should appear.
7. Click the pull-down next to the ROIs field and select the ROIs you want the delta to compare. Your changes will be saved automatically.

You can monitor delta values using the thermal imaging viewer on the **Data Viewer** page after you send the connection information to the device.

3.3.4. Configuring a Data Group

Create and configure data groups to group data from channels mapped to sensors that monitor the same piece of equipment into one data event.

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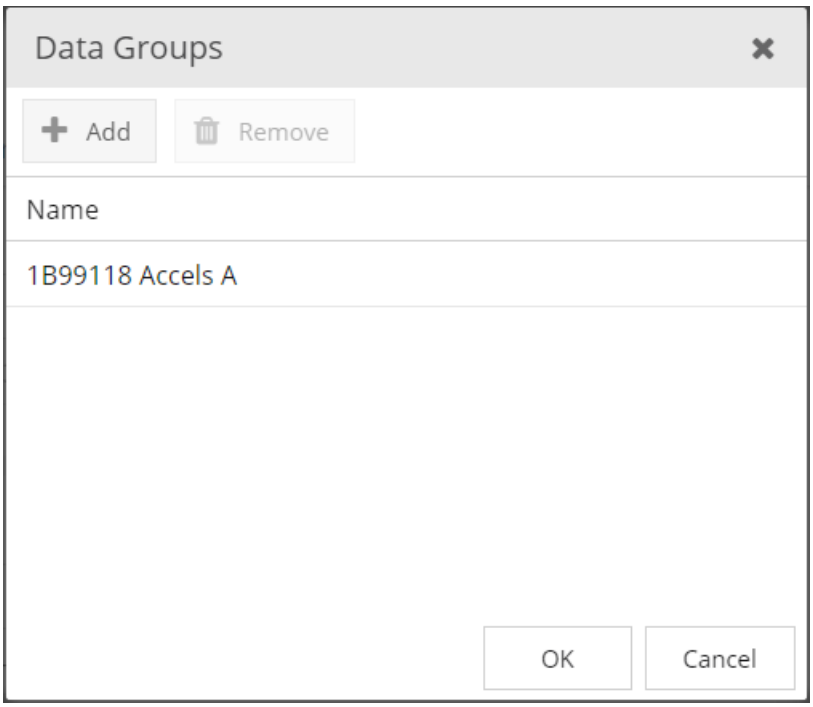
For more information on data groups, refer to the Data Groups (page 48) topic. If you are seeking to add endpoints on a wireless device, refer to the Adding Wireless Gateways and Endpoints (page 41) topic.

1. Click the **Configuration** pull-down ( ) and select **Devices**.
2. Double-click a device to navigate to the device's configuration page.
3. In the **Equipment Mapping** tab, click the **Add/Remove** button and then click **Add** to display the **Select Location** dialog box.
4. Select the top-level asset for the data group. This will likely be an equipment asset.
5. Click **Select**, then **OK**.
6. Select a channel in the **Channels** section and click **Select Data Group**.
7. In the **Select Data Group** dialog box, select the data group you just created in the **Data Group** listbox.



8. Click **OK** to assign the channel to that data group.

To learn how to map channels on your device to sensor-level assets in your data group, refer to the Mapping Device Channels and Data Groups (page 35) topic.

3.3.4.1. Data Groups

Learn what data groups are and when they may be useful.

When you configure a device in InsightCM, you assign the device channels to one or more data groups. A *data group* is a set of channels mapped to sensors that monitor the same piece of equipment. Data groups are useful in situations where a single device monitors more than one piece of equipment.

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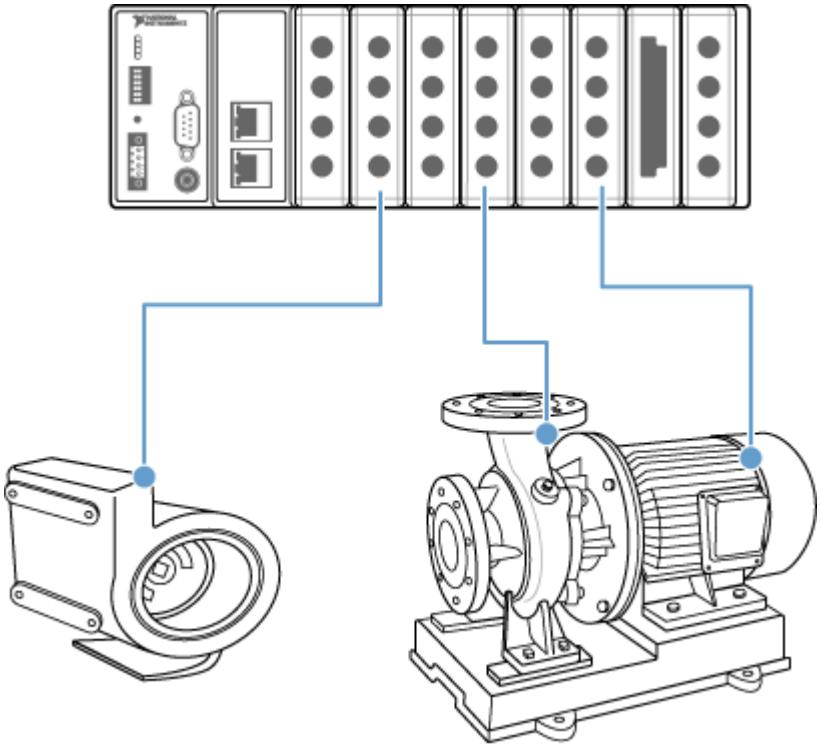
Assigning the channels monitoring each piece of equipment to different data groups allows you to configure unique behavior for each group of channels even if all of the channels belong to the same device.



3.4. Finding or Setting a Device IP Address

Locate or add the IP address of a device to add it to the server.

Before you begin, power on your Cutsforth monitoring device and connect a removable drive. Use either a type C drive or a type A drive with a type C converter. If you are using an encrypted USB flash drive, make sure that it is formatted to use the FAT32 file system.

Once you have mounted your Cutsforth monitoring device, either find and use the device's IP address or set the IP address to one you receive from your IT department. In either case, save a copy of and update several fields in the device's networkInfo.json file.

The following table shows all supported values for the **IP Address Request Mode** field:

Value	IP Address Type
1	Static
2	DHCP or Link Local
3	Link Local Only
4	DHCP Only

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1. Insert the USB drive into the USB port on the controller front panel.

   When the USER1 LED light is solid, it indicates that the device is reading from or writing to the settings file.
2. Remove the USB drive when the USER1 LED starts blinking again.
3. Insert the USB drive into a USB port on a computer.
4. Navigate to the following directory on the USB drive:

   `<RootLevel>:\InsightCM\download\NI-cRIO-ModelNumber-SerialNumber`
5. Create an upload folder in the InsightCM folder if one does not already exist.
6. Save a copy of the **networkInfo_<device hostname>.json** to the following location on the USB drive:

   `<RootLevel>:\InsightCM\upload`

   > If you save the file in another location, the device will not read it.
7. Open **networkInfo_<device hostname>.json**.
8. Locate the IP address within the object that contains `"IsPrimary":"true"`.

   The following name/value pair defines the IP address:

   `IPAddr:x.x.x.x`
9. Enter a new value in the IP address field for the primary object.

   > If using dynamic host configuration protocol (DHCP), record the IP address. However, Cutsforth recommends using static addresses.
10. To assign a static IP address, change the **IP Address Request Mode** value to 1.
11. Enter new values in the **Subnet Mask** and **Gateway** fields in the primary object according to the information you receive from your IT department.
12. Save and close the file.
13. If you made changes to the file, complete the following steps to apply your changes to the device:
    a. Insert the USB drive back into the USB port on the controller front panel.

       When the USER1 LED light is solid, it indicates that the device is reading network and connection properties.
    b. You can remove the USB drive when the USER1 LED returns to blink steadily.
    c. Reinsert the USB drive into a computer and browse to **<RootLevel>:\InsightCM**.
    d. Verify the **applied** folder contains **networkInfo_<device hostname>.json**.

3.5. Permission-Based Access to the Web Application

The server implements authentication for users by providing permissions to groups of users. Permissions serve as access rights that control the ability of the users to view or make changes to specific pages

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in the web application. Therefore, you might not see pages, tabs, or components described in this help system, or you might not be able to edit particular settings. When possible, this help system documents the permissions required to perform actions so you can seek assistance from a user who possesses the required permissions.

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4. Customizing Your InsightCM System

Configure the way your system performs different tasks.

Before you begin, set up equipment assets (page 14) and monitoring devices (page 31).

Complete the following tasks according to your customization goals.

- Configuring Alarms (page 52)— Set alarms to monitor unusual activity and configure alarms to send email alerts.
- Learn about device communication and configuration (page 75)—Review, update, and configure your devices for your condition-monitoring needs.
- Learn about data sources (page 71)—Learn which data sources InsightCM supports.
- Modify an asset type (page 85)—Modify properties, default trend alarm rules, and default fault frequency sets for all assets of a specific type.
- Learn about operating states (page 60)—Use operating states to set different collection settings and/or alarm levels for your assets.
- Add fault frequencies (page 88)—Configure fault frequencies for different assets on the Asset Configuration page and view them with spectrum data in the data viewer.
- Assign features (page 89)—Specify what features you want an asset to calculate.
- Batch editing assets (page 91)—Edit multiple assets at one time using an exported spreadsheet.
- Validate sensor data (page 96)—Ensure that sensors are returning valid data.

4.1. Configuring Alarms

Set alarms to monitor unusual activity and configure alarms to send email alerts.

Before you begin, configure your asset tree (page 13), add Cutsforth monitoring devices (page 31), and acquire data (page 38).

Devices continuously evaluate alarm rules. However, some devices either do not have the ability to evaluate the alarm rule or do not take continuous measurements. With the exception of Low Rate Feature Trend Alarms, the server evaluates alarm rules wherever data is received from the device.

Configure alarms to trigger based on equipment activity.

1. Configure an alarm rule.

Configure a trend alarm rule (page 53)	Monitor the condition of your equipment by configuring trend alarm rules that indicate when an asset enters a severe state.
Configure a spectral alarm rule (page 59)	Configure an alarm for spectral frequencies to monitor the energy level of each frequency.

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2. Set up email notifications–Receive immediate notification of assets entering a severe state by directing InsightCM to send you email notifications.
3. Acknowledge trend data (page 69)–Move an alarm instance from Active Trend Alarm to a log of alarm instances without clearing the instance.
4. Learn conditions for setting and clearing alarms (page 69)–Familiarize yourself with when and how InsightCM sets and clears alarms and determine if you want to refine an alarm rule with hysteresis, on and off delays, custom file lengths, and pre-triggers.

Define trend alarm rules either by asset types (page 53) or by auto-configuring levels (page 55).

4.1.1. Configuring a Trend Alarm Rule

Configure a trend alarm rule for an equipment asset.

Before you begin, assign at least one feature (page 89) to the asset for which you are configuring a trend alarm rule.

A *trend alarm rule* is a group of settings that causes InsightCM to set an alarm based on trend behavior. In most cases, you will configure trend alarm rules for each sensor asset, but you configure trend alarm rules directly on MCSA equipment assets. To set a trend alarm rule, define levels of severity for data that will set the alarm. You can manually configure these levels or auto-configure them using a baseline of data.

1. Click the **Configuration** button ( ) to navigate to the Asset Configuration page.
2. In the right side configuration panel, select the **Trend Alarms** tab.
3. Click **Add** to display the **Trend Alarm Rule** dialog.
4. In the top left corner of the dialog box, use the pull-down menu to choose a feature you want to apply.
5. In the adjacent pull-down, specify whether this alarm trips for trend values that are greater than or less than the compared value.
6. Using the Operating State pull-down menu, choose whether the rule applies to all operating states or to one specific operating state.

   If you select **All** for the Operating State pull-down menu, you can not auto-configure levels from the baseline since the average data will differ for each feature type.

7. Use one of the following two methods to define severity levels for the trend alarm rule.

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Methods	Instructions
Define levels based on a comparison value that you set.	1. Click the **Add** button in the Levels section to display the **Trend Alarm Rule** dialog box. 2. Specify the urgency of the level in the **Severity** pull-down menu. 3. Specify the threshold you want the Cutsforth monitoring device to compare trend values against in the **Compare To** field. 4. Check the **Send Email** checkbox to enable email options for the web application to use when the alarm trips. 5. If there is more than one level that you want to set for a trend alarm rule, repeat these steps as needed.
Auto-configure levels based on a value that InsightCM calculates from previously acquired data. To use auto-configure, you must have already acquired data.	1. Check the **Auto-configure level from baseline** checkbox and a new Edit button should appear. 2. Click the **Edit** button that appears next to the checkbox label to display the **Auto-Configure Alarm Rule** dialog box. 3. In the **Calculation** pull-down menu, specify how you want the Cutsforth monitoring device to calculate the compare value. 4. Click **Add** to display the **Trend Alarm Rule Level** dialog box. 5. Specify the urgency of the level in the **Severity** pull-down menu. 6. In the **Compare To** field, specify the initial value that the web application uses to calculate the threshold. 7. Check the **Send Email** checkbox to enable email notifications to be sent when the alarm trips.

8. (Optional) If you use auto-configured levels, set a baseline.
   a. Click the **Calendar** button to bring up the **Select Date Range** dialog.
   b. Define a range of dates in the **Start** and **End** text fields with data you want to use to calculate a baseline. Click **OK**. Narrow the data set by clicking and dragging to zoom into a portion of the timeline. Double-click the graph to zoom out again.
   c. Click **Set Baseline**.

   If you do not set a baseline, InsightCM does not auto-configure levels.

4.1.1.1. Severity for Alarm Rules

Severity is a user-defined value that can be useful for setting the priority of an alarm condition. Use low severity for conditions that are outside normal operating parameters but still within acceptable limits. Use high severity for conditions where an analyst should review the data as soon as possible.

When an alarm is triggered, the server retains the data sets from that event. The server keeps track of the maximum severity for the alarm instance. Whenever a new maximum severity is tripped, the server retains the corresponding data sets. However, when an alarm transitions between severities, the server only retains the trend point data.

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Table 1. Alarm Rules with Differing Severities

Feature	Condition	Set Point	Severity	Send Email?
True Peak	Above	0.2	1	⊘
True Peak	Above	0.4	2	✓

Auto-Configuring Severity Levels

Use trend baselines to auto-configure severity levels for an alarm rule.

Before you begin, collect data from the asset for which you are configuring an alarm rule.

1. Click the **Configuration** button ( ) and select a sensor-level asset.
2. In the configuration pane, select the **Trend Alarms** tab.
3. Find and select an alarm and click **Edit**.
4. Select a feature and operator combination you want to auto-configure severity levels for.
5. Select an operating state using the **Operating State** pull-down menu.

   If you select **All**, you will not have the option to auto-configure levels from a baseline.

6. Check the **Auto-configure levels from baseline** checkbox to activate a new **Edit** button.
7. Click the **Edit** button.
8. Choose a calculation type using the corresponding pull-down menu.
9. Add severity levels and click **OK**.
10. Below the table of severity levels, click the **calendar** button to use data collected within a certain date range as your baseline.
11. Click **OK** to select the date range and to activate the **Set Baseline** button.
12. Click **Set Baseline** and **OK** to save your changes.

The alarm you have just modified now has severity levels that InsightCM has configured based on collected data.

Trend Baseline Minimum Data Ranges

Determine the minimum range of data that the web application should use to calculate a baseline.

Option	Description
Minimum Trend Points	Specifies the minimum number of trend points used to calculate a baseline.
Minimum Days	Specifies the minimum number of days over which data must be collected before calculating a baseline.
Minimum Standard Deviation	Specifies a standard deviation to replace the actual standard deviation of the baseline if the actual standard deviation goes below this value.

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4.1.1.2. Configuring Hysteresis

Specify a threshold above or below the severity level that sets an alarm to reduce alarm instances from a noisy signal.

> This functionality only applied to features calculated on the device.

Before you begin, configure a trend alarm rule (page 53).

Configuring hysteresis is useful for preventing an alarm from clearing immediately after it is set. To learn more about hysteresis, refer to Conditions of Setting and Clearing Alarms (page 69). Specify an offset value from the **Compare To** value that clears an alarm.

1. Click the Navigation menu and go to **Alarms > Trend Rules**.
2. Find and select the trend rule for which you want to configure hysteresis.
3. Click **Edit** to bring up the **Trend Alarm Rule** dialog.
4. Below the sample of data in the dialog, configure the hysteresis value in the Hysteresis text field.
5. Click **OK**.

The alarm rule that you have modified now clears an alarm when trend values cross the threshold for the hysteresis you specified.

If you want to refine the conditions for setting an alarm further, consider configuring an on and off delay (page 56).

4.1.1.3. Configuring On and Off Delay

Specify a time delay before InsightCM sets or clears an alarm to reduce alarm instances from a noisy signal.

Before you begin, configure a trend alarm rule (page 53). Configure hysteresis (page 56) before configuring Off Delay.

On Delay specifies the amount of time that trend values must remain above the Compare To value before InsightCM sets an alarm. *Off Delay* specifies the amount of time that trend values must remain below or above the Compare To, or at the hysteresis value, before InsightCM clears the alarm. To learn more about On Delay and Off Delay values, refer to Conditions for Setting and Clearing Alarms (page 69).

Complete the following steps to set an On Delay or Off Delay value for an alarm.

1. Click the **Navigation** menu (⌄) and select **Alarms > Trend Rules**.
2. Find and select the trend rule to configure its delays.
3. Click **Edit** to bring up the **Trend Alarm Rule** dialog.

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4. Below the sample of data in the dialog, configure the delay values in seconds using the corresponding spin boxes.
5. Click **OK**.

The alarm rule that you have modified will now delay the setting and/or clearing of an alarm instance by the amount of time you specified.

4.1.1.4. Specifying a File Length for Data Collection

Specify file lengths for data that you want your monitoring devices to collect when asset conditions set a higher severity alarm.

Before you begin, configure a trend alarm rule (page 53).

InsightCM uses the value you specify for the file length to determine the size of the data collection when asset conditions set an alarm and cross a higher severity threshold.

> This option will override the collection settings determined by the operating state.

Complete the following steps to specify a file length for the data collected for an alarm.

1. Click the **Navigation** menu (˅) and select **Alarms > Trend Rules**.
2. Find and select the trend rule to configure its custom file length.
3. Click **Edit** to bring up the **Trend Alarm Rule** dialog.
4. At the bottom of the dialog, uncheck the **Use default collection length** checkbox to activate the **File Length** text field.
5. Use the **File Length** text field to specify how many seconds of data InsightCM will collect when conditions set a higher severity alarm.
6. Click **OK**.

The alarm rule you have just modified now collects trend data files for the length of time you specified for File Length.

4.1.1.5. Specifying a Pre-Trigger Length for Data Collection

Delay the start of data collection when asset conditions set a higher severity alarm.

Before you begin, configure a trend alarm rule (page 53).

InsightCM uses the value you specify for the pre-trigger length to determine how long after asset conditions set an alarm and cross a higher severity threshold to wait before collecting data.

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> This option will override the collection settings determined by the operating state.

Complete the following steps to specify a pre-trigger length for an alarm.

1. Click the **Navigation** menu (˅) and select **Alarms > Trend Rules**.
2. Find and select the trend rule for which you want to specify a pre-trigger value.
3. Click **Edit** to bring up the **Trend Alarm Rule** dialog.
4. At the bottom of the dialog, uncheck the **Use default collection length** checkbox to activate the **Pre-Trigger** text field.
5. Use the **Pre-Trigger** text field to specify how many seconds InsightCM will wait after asset conditions set a higher severity alarm before collecting data.
6. Click **OK**.

The alarm rule you have modified now waits the length of time you specified for the pre-trigger before collecting data.

4.1.1.6. Defining a Trend Alarm Rule for Asset Types

Define a trend alarm rule for all assets of a certain type.

Edit an asset definition to configure a trend alarm rule for all assets of a certain type.

> The changes you make to the definition of an asset type will apply to all applicable current and future assets.

1. Click the **Navigation** menu (˅) and select **Systems > Asset Definitions**.
2. Select a definition to edit and click the **Trend Alarm Rules** tab.
3. Click **Add** to display the **Trend Alarm Rule** dialog box.
4. Choose the feature you want the rule to apply to from the pull-down menu in the dialog box.

   > Only features that have been toggled to default in the Features tab for this asset type will be available options in this pull-down menu.

5. In the adjacent pull-down, specify whether this alarm triggers for trend values that are greater than or less than the compare value.
6. Choose the operating state to which you want this trend alarm to apply using the **Operating States** pull-down menu.

   > If you choose to make the trend alarm active in all operating states, you will be unable to auto-configure levels from the baseline because baselines will differ for each state.

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7. Use one of the following two methods to set levels for the trend alarm rule.

Methods	Instructions
Set levels based on a set Compare value that you define.	1. Click **Add** in the **Levels** section to display the **Trend Alarm Rule Level** dialog box. 2. Specify the urgency of the level using the **Severity** pull-down menu. Spectral alarm rules are only calculated on the server. 3. Specify the multiplier to which you want the web application to compare trend values in the **Compare To** spin box. 4. Check the **Send Email** checkbox to enable email options for the web application to use when the alarm trips. If you have not configured an address group and a specific email template for an alarm type, you may do so for the default group and email template that the web application already has loaded. 5. When prompted about applying the alarm rule to all the assets of this type, select **Yes** or **No**.
Set levels based on a value calculated from previously acquired data.	1. Check the **Auto-configure level from baseline** checkbox and a new **Edit** button should appear. 2. Click the **Edit** button that appears next to the checkbox label to display the **Auto-Configure Alarm Rule** dialog. 3. In the **Calculation** pull-down menu, specify how you want the web application to calculate the **Compare To** value. 4. Click **Add** to display the **Trend Alarm Rule Level** dialog. 5. Specify the urgency of the level in the **Severity** pull-down menu. 6. In the **Compare To** field, specify the initial value that the web application uses to calculate the compare value for the level. 7. Place a checkmark in the **Send Email** checkbox to enable email options for the web application to use when the alarm trips.

8. If available, use the following options to override the collection settings determined by an operating state.
   - **User default collection length**—Uncheck this option to enable the File Length and Pre-Trigger Length options. InsightCM uses the values you set for these options when the alarm condition is triggered and when the alarm severity changes.
   - **File Length**—Specify how many seconds of data to collect while the alarm rule is active.
   - **Pre-Trigger Length**—Specify how many seconds of data to collect before the event that triggers the alarm rule.

4.1.2. Configuring Spectral Alarm Rules

Configure an alarm for spectral frequencies to monitor the energy level of each frequency.

Before you begin, ensure that you have collected data from the sensor asset you are setting a spectral alarm for.

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Spectral alarm rules are only calculated on the server.

A spectral alarm rule allows you to set alarms for every frequency of a spectrum to ensure that the energy level at each frequency is acceptable.

Complete the following steps to configure a spectral alarm rule for a sensor asset.

1. Click the **Configuration** button ( ) to navigate to the Asset Configuration page.
2. Select the sensor asset you want to configure a spectral alarm for.

   Motor (MCSA) and Voltage Bus are equipment assets that also support spectral alarms.

3. Click the **Spectral Alarms** tab and click **Add** to display the **Spectral Alarm Rule** dialog box.
4. Choose an operating state and integration type.
5. Select a data event from the list.
6. Expand the **Add Level** pull-down menu and select the severity level you want to specify.
7. Draw the line representing the severity level on the graph.
   a. Using the preview line, align your cursor to the g rms height with the corresponding length of the waveform and click to set the severity level.
   b. For data that fluctuates along the length of the waveform, raise or lower your cursor, move it along the length of the waveform, and click to set the same severity level for another section of the waveform.
8. Click the checkmark button to commit the line of severity levels you have drawn.

   InsightCM sets the scale of spectral frequencies automatically based on collected data, but you can disable the auto-scale and set a maximum scale by clicking **Set Scale**.

9. In the top right corner of the dialog, click **Done**.
10. (Optional) Repeat steps 5 through 9 to configure additional alarm levels as needed.
11. Click **OK** to save your changes.

4.1.3. Operating States

Operating states set different collection settings and/or alarm levels for your assets.

For many assets, it is useful to define discrete operating states that have different collection settings and/or alarm levels. For example, if a motor is running, you may want to collect data more frequently than when the motor is idle or off. Consider the following examples of operating states turbine which has a tachometer sensor with a speed feature.

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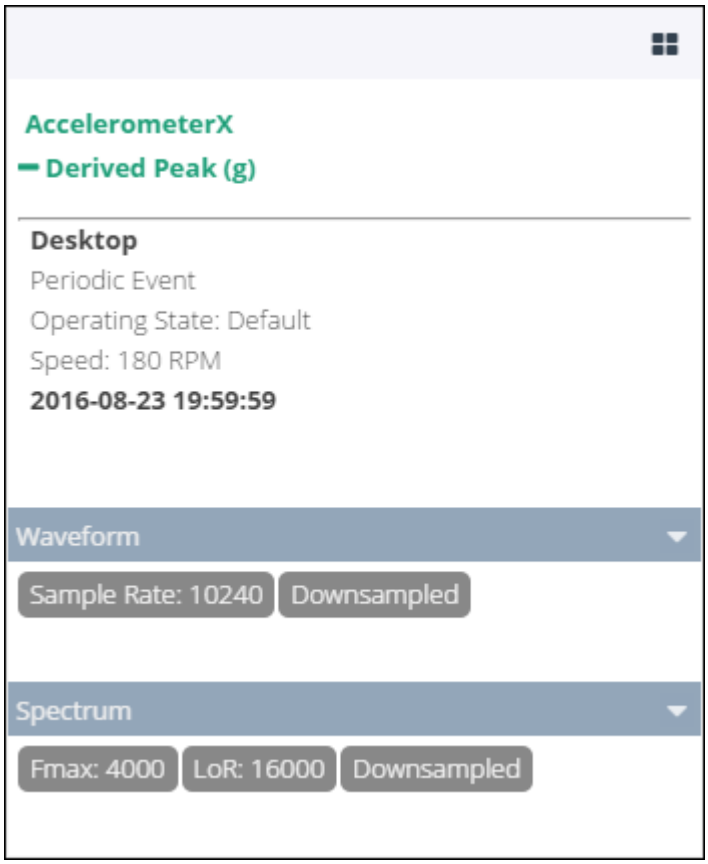
Operating States	Settings
Run-Up	▪ Enter state when RPM rises above 200 ▪ Collect a data set every 30 seconds ▪ Write data sets whose length is 10 seconds ▪ Exit state when speed is above 1200 RPM for 20 seconds or speed is less than 200 RPM for 20 seconds
Default	▪ Collect a data set once per hour ▪ Write data sets whose length is 4 seconds, including 1 seconds of pre-trigger data

4.1.3.1. Transitions Between Operating States

Defining an operating state for unique equipment conditions allows the device to dynamically switch between collection behaviors. As the Run-Up operating state in the previous example shows, operating states express a condition to enter the state and a condition to exit the state. While in the state, the collection settings and conditions can be configured differently than when the asset is in the default state.

4.1.3.2. How Operating States Affect Data Visualization

The metadata pane on the Data Viewer page displays the operating state that was active when the device collected the data.



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4.1.3.3. Editing an Operating State

Change operating states that you can assign to an alarm.

1. Select the Navigation menu (⌄) and select **System > Operating States**.
2. Select an existing operating state and click **Edit**.
3. Adjust the name and weight of the operating state as needed.
4. Create additional operating states by clicking the **Add** button and specifying the name and weight of the new operating state.

4.1.3.4. Gating Conditions for Data Sets and Tags

Use gating conditions to prevent data from being acquired when the condition is not met.

When you enable a gating condition for an operating state, the server evaluates each data set collected under that operating state to see if the gating condition is true. For example, you might want to store data sets only when the equipment is running as indicated by an RMS above 0.1 g. If the gating condition is true for a data set, the server stores the data set. Otherwise, the server discards the data set.

Force trigger always stores a data set and ignores gate conditions.

Trigger Type	Evaluated
Time	✓
Delta EU	✓
Alarm	✓
Force	⊘

The gating conditions set for an operating state do not affect burst mode data sets. Instead, burst mode data sets are evaluated for gating conditions set in the Burst Mode Collection Conditions (page 65) section on the **Device Properties** tab of the Device Configuration page.

4.1.3.5. Delta EU Triggers

You can define one or more delta EU triggers that initiate an acquisition when a feature or spectral band changes by at least a specified amount. Both positive and negative changes in value cause a delta EU trigger to fire.

If the device is unable to calculate the spectral bands on the device, the delta EU triggers will not fire on the bands.

This setting can be found on the Operating States Tab of the Asset Configuration page.

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The following process explains how the InsightCM Server monitors delta EU triggers.

Device Action	Example
When a device starts running, it sets the current value of the feature or spectral band as the baseline EU value.	Consider a feature whose value is 1 upon startup. The baseline EU value is therefore 1.
The device monitors the feature value regularly and compares it to the baseline value to check for a difference greater than the trigger level.	Consider a delta EU trigger with a delta level of 3. Given the baseline EU value of 1, the device checks for values less than -2 and greater than 4 to see if the trigger condition is met.
If the current value increases or decreases by the delta level, the trigger fires and the device performs an acquisition.	If the current value is 8, the device performs one acquisition.
The device sets the value that caused the trigger to fire as the new baseline value.	The new baseline EU value is 8.
The device continues to calculate the feature value to see if the difference from the baseline is greater than the delta level.	Given the new baseline of 8, the device checks for values less than 5 and greater than 11.

Only the initial start-up value and values that cause delta EU triggers to fire can serve as the baseline EU value. In other words, when a device performs a time-, alarm-, or force-triggered acquisition, the device does not update the baseline EU value with the feature value from that acquisition.

4.1.3.6. MCSA Operating States

An electric motor has discrete operating states such as On (Default), Startup, and Off. The following table lists the default operating states of MCSA devices.

Operating States	Default Settings
Default	▪ Collect a data set once per hour. ▪ Collect trend values every 5 minutes. ▪ Write data sets whose length is 3 seconds, including 1 second of pre-trigger data.
Startup	▪ Enter state when **Percent Full Load Amps** rises above 200% Full Load Amps (FLA), where FLA specifies the motor full load current in amperes according to the motor nameplate. ▪ Collect a data set when entering state. The length of this data set is 30 seconds, including 1 second of pre-trigger data. ▪ Exit state when **Percent Full Load Amps** is less than 110% FLA for 5 seconds or the state lasts for 30 seconds.
Off	▪ Enter state when **Percent Full Load Amps** falls below 25% FLA. ▪ Collect a data set once per hour. ▪ Collect trend values every 5 minutes. ▪ Exit state when **Percent Full Load Amps** rises above 25% FLA.

4.1.3.7. Methods for Initiating Data Set Collection

Cutsforth Monitoring Devices continuously or wirelessly monitor data from equipment. However, these devices collect and log data only when initiated by one of several types of triggers.

Use one of the following triggers to collect and log data.

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Automatic Triggers

Either the software on the devices or the server automatically initiates a data set collection when the following triggers fire.

Use Case

Type	Description	Where to Configure
Time Interval	Collect a data set at specific times of day or intervals of time. Ensure that trends are complete enough to provide a useful display of machine conditions.	Operating States tab on the Asset Configuration page
Delta EU	Collect a data set when a feature or spectral band value changes by a specified amount. Ensure data is collected at the time that a rapid change in measurements occurs.	
Enter Condition	Collect a data set when the enter condition for an operating state is met. View the measurements from the time that equipment changed its status.	
Exit Condition	Collect a data set when the exit condition for the operating state is met. View the measurements from the time that equipment changed its status.	
Alarm Set	Collect a data set whenever an alarm condition is met. Access data from the time an alarm condition occurred. Data sets are sent to the server only when the threshold for new maximum severity is crossed. Otherwise, only trend points are sent to the server, including when an alarm clears.	Alarms page
Alarm Clears	Collect a data set whenever an alarm clears. Access trend point data from the time an alarm condition ends.	
Burst Mode	Collect high-resolution data sets at specific times of day or intervals of time. Troubleshoot equipment with data that may indicate an issue.	Device Properties tab on a device's configuration page

Example: Relationships Between Different Trigger Types

The variety of triggers available in the InsightCM Server means that devices can perform collections more frequently than the standard time-based intervals. Consider a device whose configuration includes the following settings.

Setting	Value
Total collection duration	1 time unit
Time-based trigger	Every 7 time units
Delta EU trigger level	3 engineering units
Alarm rule	▪ Set Point - 75 degrees ▪ Condition - Above

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High-Resolution Data Acquisition with Burst Mode

What happens to the device while burst mode is active?

The device suspends normal operation and does not check for changes, such as alarms or operating states, for about 30 seconds before and after acquiring high-resolution data to allow the acquisition anti-aliasing filters to settle.

What happens to high-resolution data if the device cannot connect to the server?

By default, InsightCM discards high-resolution data if the device cannot connect to the server.

Requesting a Periodic Acquisition

Collect data by using force trigger and view a periodic acquisition.

Complete the following steps to force trigger and view a periodic acquisition.

1. Click the **Action** menu ( ) on the Trend viewer toolbar and select **Force Trigger**.
2. If the Trend viewer already contains curves for the features or sensors of interest, click the **Refresh trend data** button ( ). You might need to wait several seconds to see force-triggered data in viewers because devices must perform the periodic acquisition, and then InsightCM must receive and store the data.

Manual Data Acquisition

To view new trend values and sensor measurements between scheduled periodic acquisitions, you can manually request that a device perform an acquisition. These requests are known as force triggers. Force triggers are useful when you want to view current asset data without waiting for the next scheduled acquisition.

You can perform a force trigger from the Action menu ( ) on the Trend viewer toolbar on the Data Viewer page or on the Devices or Device Dashboard page.

What Is the Duration and Sampling Rate of the Acquisition?

Devices perform force-triggered acquisitions according to the sampling rate, duration, and other periodic-acquisition settings configured in the web application.

Do Force Triggers Affect Regularly Scheduled Periodic Acquisitions?

No. Force-triggered acquisitions do not affect the timing of scheduled periodic acquisitions that devices perform.

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Scheduling Temporary High-Resolution Data Acquisition

Schedule a high-resolution data acquisition on a device.

You can also schedule a burst data set collection to run on a device periodically so you can compare high-resolution data over time.

Complete the following steps to schedule high-resolution data acquisition on a device:

1. Click the **Configuration** pull-down ( ) and select **Devices**.
2. Double-click a device and select the **Device Properties** tab.

   This tab is not available for thermal imaging device configuration pages.

3. Select the **Enable burst mode** checkbox.
4. In the **Burst Collection Conditions** section, click **Time**.
5. In the **Edit Condition** dialog box, specify how frequently to acquire high-resolution data.
6. In the **Burst Collection Settings** section, specify the sample rate in Hz and acquisition length in seconds that you want InsightCM to use for the scheduled high-resolution data acquisition.
7. Update the device configuration.

4.1.4. Setting up Email Alarm Notifications

Configure InsightCM to send alarm notification emails.

Before you begin, configure your role with serverSettings_edit permissions, create an address group (page 67), and create an email template (page 68). Refer to Relationships Between User Accounts and Permissions (page 134) for more information about permissions.

1. On the server machine, in File Explorer, navigate to the **ProgramData\Cutsforth\InsightCM\Auth** folder.
2. Open the **SmtpConfiguration.json** file in a text file editor.

   The InsightCM Server acts as an SMTP client and sends messages to an SMTP server when you edit this file with information about the SMTP server.

3. Modify each line category according to your server information.

```
"Host": "<servername>",

"Port": "<port number>",

"UseSsl": <true or false>,

"RequireAuthentication": <true or false>,

"Username": "<username>",
```


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```
"Password": "Secret\\Password", "Secret\"Password"
```

> If your password contains backslashes or double quotations, you must use double backslashes or a backslash and double quotations respectively as shown in the above example.

```
"TimeoutSeconds": <number>,

"FromAddress": "yes-reply@localhost",

"TestMode": <true or false>
```

> Test Mode prevents the server from sending emails, even when you run commands from the InsightCM console. Enable the SMTP.Emails tracepoint to view messages that the server writes to the trace log.

4. Save the .json file and open Windows Services.
5. Find and select **InsightCM <version>** and click **Restart**.

> Restarting the InsightCM service enables the software to read the new SMTP settings.

Add an email template and address group to an alarm (page 68).

4.1.4.1. Creating Address Groups

Create and maintain lists of email addresses to which InsightCM sends alarms and other notifications.

If there are several users that need to receive certain email notifications, create an *address group*. Use address groups to keep a diverse portfolio of users informed regarding the state of InsightCM or the equipment it is monitoring. Complete the following steps to create a new address group and assign the group to an alarm rule.

> To customize the email sent for a specific alarm rule, create an email template and assign it to the alarm rule. Refer to Creating Email Templates (page 68) to learn how to do so.

1. Click the Navigation menu (˅) and select **Options**.
2. Navigate to the Notifications section, select **Address Groups**,and click the **Add** button.
3. Enter a name for the address group in the Name text box.
4. Enter valid user email addresses and separate each email address with a comma, new line, space, or semicolon.
5. Configure the level of visibility that individual users have regarding other recipients of the same email notification by using the various recipient text boxes.
6. Click **OK** to add the new address group to the Selected Group pull-down list.

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> Once you add email addresses to an address group, keep at least one email address saved to the address group.

4.1.4.2. Creating Email Templates

Create templates for email notifications that the InsightCM Server sends when an alarm is set.

1. Click the Navigation menu (˅) and select **Options**.
2. Scroll down to the Notifications section and select **Email Templates**.
3. Select the default option from the Template pull-down.
4. (Optional) Click the **Edit** button to give the email template a descriptive name and click **OK**.
5. (Optional) Write a brief description of what information this template will send about an alarm.

   > The contents of this description do not show up in the alarm email.

6. Write an informative subject line for the email template.
7. Write the contents of the email and click **OK**.

   > Define email templates independently of address groups to pair one address group with multiple email templates or one email template with multiple address groups. You may want to notify a single individual when a low-severity alarm occurs, but notify several individuals with the same message when a high-severity alarm occurs.

Add your email template to an alarm rule (page 68).

4.1.4.3. Adding an Email Template and Address Group to an Alarm

Assign an email template to an alarm level.

Before you begin, create an email template (page 68) and create an address group (page 67).

1. Click the Navigation menu (˅) and select **Alarms**.
2. Select an alarm and click **Edit**.
3. Under Levels, select an alarm severity level and click **Edit**.
4. Select the **Send Email** checkbox.
5. Select an address group.
6. Select an email template.
7. Click **OK**.

4.1.4.4. Testing Email Notifications

Use the console to test whether InsightCM sends email notifications successfully.

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Before you begin, set up email alarm notifications.

1. On the server computer, open Command Prompt.
2. Navigate to the folder in which InsightCM is saved using the following command:

   ```
   cd C:\Program Files\Cutsforth\InsightCM
   ```
3. Execute the following commands to test email notifications:

   ```
   InsightCMConsole.exe sendtestemail -grp [address group name]
   ```
4. Verify whether a test email notification is sent to those in the address group.

4.1.5. Acknowledging an Alarm

View the relevant data for and acknowledge a trend alarm.

1. Click the Navigation menu (˅) and select **Alarms > Active Trend**.
2. Select an alarm and click **View** to see the relevant Trend viewer data in the **Alarm** dialog.
3. Click **Acknowledge**.

   As a result, you moved the alarm instance from the **Active Trend Alarm** tab to the **Alarm Instances** dialog, though you did not clear the instance.

   > If the data rises above the set point a second time, InsightCM displays the alarm instance again on the Active Trend Alarms tab.

4.1.6. Conditions for Setting and Clearing Alarms

Alarm states and whether you acknowledge or clear the alarm determine the notification behavior of your configured alarms.

4.1.6.1. Alarm States

Once you begin collecting data, define conditions that set or clear an alarm. Alarms can have a combination of the following states.

Set	InsightCM detected that conditions for an alarm rule have been met and created an alarm instance.
Acknowledged	A user indicated awareness of the alarm. Acknowledging an alarm does not clear it, so that if the conditions for setting the alarm are met again, a new alarm instance is not logged.
Clear	InsightCM detected that the alarm rule is no longer true. A cleared alarm remains on the Active Trend Alarms tab or Active Spectral Alarms tab until you acknowledge it.

The following table lists the different alarm states the web application displays on the Alarms page.

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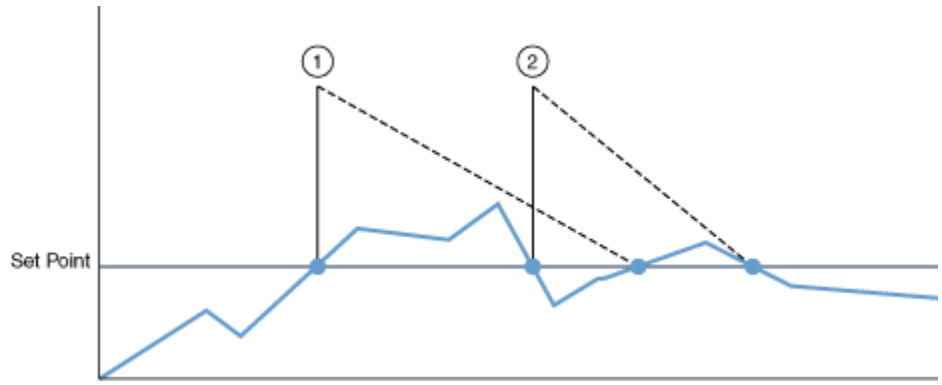
Set?	Clear?	Acknowledged?	Location on Alarms page
✓	⊘	⊘	Active Alarms tab
✓	✓	⊘	Active Alarms tab
✓	⊘	✓	Active Alarms tab
✓	✓	✓	Alarm Instances dialog box

4.1.6.2. Alarm Changes State Without Acknowledgment

To demonstrate how an alarm enters a *Set* state, consider the following illustration where an alarm is set and cleared twice. Assume that you never acknowledged the alarm. In this example, the same alarm instance remains on the Active Trend Alarms tab or Active Spectral Alarms tab the entire time even though its status transitions to *Clear* twice. Since the first instance of the alarm was not acknowledged, InsightCM collects no additional data sets and issues no new notification when the alarm enters the *Set* state the second time.



1	Alarm set
2	Alarm clear

4.1.6.3. Alarm Changes State with Acknowledgment

Consider the same scenario and data as in the previous section. If you acknowledge the alarm at either time indicated by 3 in the following illustration, the web application moves the first alarm instance from one of the Active Alarms tab to the **Alarm Instances** dialog. When the data crosses the set threshold the second time, the web application displays a new alarm instance an Active Alarms tab.

> Since the first instance of the alarm was acknowledged, InsightCM collects a new data set and issues a new notification when the alarm enters the *Set* state the second time.

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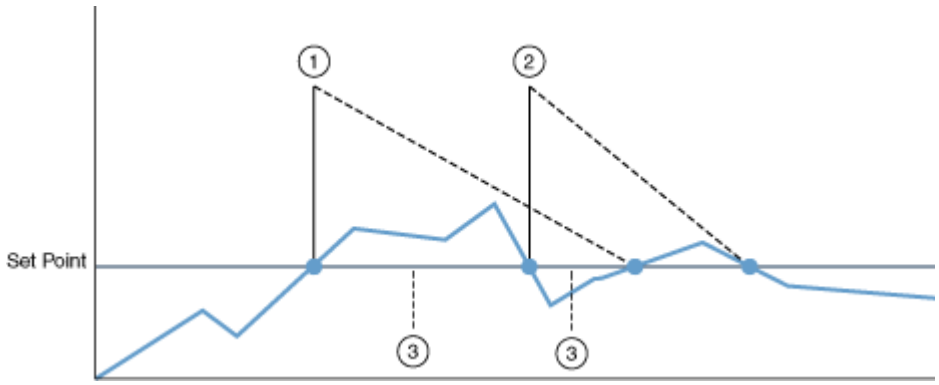
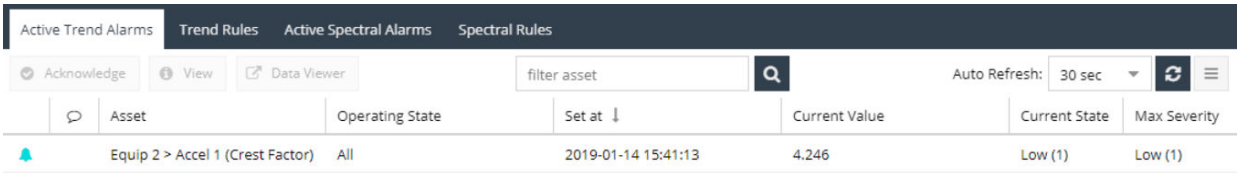


1	Alarm set
2	Alarm clear
3	Times when acknowledging the alarm will cause the web application to move the first alarm instance to the Alarm Instances dialog box after its status becomes Clear.

4.1.6.4. Viewing Alarm State Timestamps

To see the timestamps of an alarm entering *Set*, *Cleared*, or *Acknowledged* states, double-click the alarm instance on the **Active Alarms** tab.



4.2. Data Sources

4.2.1. Modbus Communication

The InsightCM monitoring devices can read data using Modbus TCP or serial communication. Modbus data will be included in the trend points stored on the server and can be used in collection triggers and alarms.

- Serial communication—The device can address one or more Modbus slaves and the Modbus slaves can communicate directly with the device.
- Ethernet communication—The device establishes a TCP connection with a Modbus slave on a specific IP address and port. The device can support TCP connections to multiple Modbus slaves.

4.2.2. OPC UA Communication

The device acts as an OPC UA (Open Platform Communications Unified Architecture) client and initiates queries from the OPC UA Server. The device establishes a connection with the specific URL of the OPC UA Server. The device typically connects through TCP.

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4.2.3. Historian Software

The device connects through TCP to the InsightCM server to access the historian software data.

4.2.4. Creating and Configuring a Data Source

Configure a data source from external sources, such as a Modbus Register, an OPC UA Tag, or a Historian Input.

1. Click **Configuration** ( ) and select **Assets**.
2. Click the **Action** menu ( ) and select **Data Sources** to display the Data Sources dialog box.
3. Click **Add** and select the type of data source you want to create.
4. Specify a name for the data source and click **OK**.
5. Select the new data source in the asset tree and configure the appropriate properties in the configuration panel.
6. Select the **Registers** (for Modbus), **Tags** (for OPC UA), or **Points** (for Historian Input) tab.
7. Click **Add** and configure the appropriate data source item properties.
8. Click **Close**.
9. Click Configuration ( ) and select **Devices**.
10. Double-click a device and click the **Data Sources** tab in the device configuration page.
11. Click **Add** and select the data source you created.
12. Select the **Modbus Register**, **OPC Tag**, or **Historian Input** checkbox and click **OK**.

> If a Historian Input has already been created, no additional Historian Inputs may be created.

4.2.5. Data Source Type Properties

4.2.5.1. Modbus Read Channel Properties

The Modbus register supports properties that affect how the device reads data.

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Property Name	Description
Register Type	▪ **Discrete Input**—The register addressed represents a sensor input or other Boolean value to read. ▪ **Coil**—The register addressed represents an output or internal bit to read. ▪ **Input Register**—The register addressed represents an analog input value or other integer value to read. ▪ **Holding Register**—The register addressed represents an analog output or internal number to read.
Address	The address of the Modbus Register to read
32-bit data type	If **true**, 32 bits will be read from the Register at the specified Address.
First word low (32-bit data type)	If checked, the 32-bit value read from the Register will have the low order word in the first 16 bits.
Floating-point (32-bit data type)	If checked, the 32-bit value read from the Register will be interpreted as a floating-point number.
Unit	Specifies the unit to be used for the Engineering Value read from the Register
Slope	The slope value, represented by m in the following equation: Engineering Value = m(Raw Value) + b.
Offset	The offset value, represented by b in the following equation: Engineering Value = m(Raw Value) + b.

4.2.5.2. Modbus Serial Data Source Properties

The Modbus Serial data source supports configurable properties that affect how the device communicates with the Modbus slave.

> Modbus Serial properties are available only after you add a Modbus Serial data source (page 72).

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Property Name	Description
Address	The address of the Modbus slave with which you want to communicate
Interval (sec)	How often the device process reads the Modbus slave, in seconds
Serial Type	The type of data transmission through serial ports: ▪ **RTU**—Sends data using the Remote Terminal Unit (RTU), which is a binary data unit ▪ **ASCII**—Sends data using human-readable characters
Baud Rate	The baud rate of the Modbus slave with which you want to communicate. The default is 9,600.
Parity	The parity of the Modbus slave with which you want to communicate ▪ **None**—Use no parity bit. If you specify **Vibration** for parity, the number of stop bits indicating the end of a frame is **2**. ▪ **Odd**—Use odd parity. If you specify **Odd** for parity, the number of stop bits indicating the end of a frame is **1.5**. ▪ **Even**—Use even parity. If you specify **Even** for parity, the number of stop bits indicating the end of a frame is **1.5**.
Stop bits	The number of stop bits used by the Modbus slave should reconfigure the misguided syntax globally you want to communicate with. You can select **1** or **2**.
Data bits	The number of data bits used by the Modbus slave with which you want to communicate. You can select **7** or **8**.
Flow Control	The flow control of the Modbus slave with which you want to communicate. ▪ **None**—Does not use flow control. The transfer mechanism assumes buffers on both sides of the connection to be large enough to hold all data transferred. ▪ **XON/XOFF**—Uses the XON and XOFF characters to perform flow control. When the receiving buffer is almost full, the transfer mechanism controls the input flow by sending XOFF. When the buffer receives XOFF, the transfer mechanism controls the output flow by suspending transmission. ▪ **RTS/CTS**—Uses the RTS output signal and the CTS input signal to perform flow control. When the receiving buffer is almost full, the transfer mechanism controls the input flow by unasserting the RTS signal. When the buffer unasserts the CTS signal, the transfer mechanism controls the output flow by suspending the transmission. ▪ **XON/XOFF and RTS/CTS**—Uses the XON and XOFF characters, the RTS output signal, and the CTS input signal to perform flow control. When the receiving buffer is almost full, the transfer mechanism controls the input flow by sending XOFF and unasserting the RTS signal. When the buffer receives XOFF, the transfer mechanism controls the output flow by suspending transmission. ▪ **DTR/DSR**—Uses the DTR output signal and the DSR input signal to perform flow control. When the receiving buffer is almost full, the transfer mechanism controls the input flow by unasserting the DTR signal. When the buffer unasserts the DSR signal, the transfer mechanism controls the output flow by suspending the transmission. ▪ **XON/XOFF and DTR/DSR**—Uses the XON and XOFF characters, the DTR output signal, and the DSR input signal to perform flow control. When the receiving buffer is almost full, the transfer mechanism controls the input flow by sending XOFF and unasserting the DTR signal. When the buffer receives XOFF and unasserts the DSR signal, the transfer mechanism controls the output flow by suspending transmission.
Read Timeout (sec)	How long the read process waits for a response from the Modbus slave when initializing or reading from the device. If the Modbus slave does not respond within the specified timeout, the device attempts to re-open a connection after 30 seconds.

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4.2.5.3. Modbus TCP Data Source Properties

The Modbus TCP data source supports configurable properties that affect how the device communicates with the Modbus slave.

Modbus TCP properties are available only after you add a Modbus TCP data source (page 72).

Property Name	Description
IP Address	The TCP/IP address of the Modbus slave with which you want to communicate.
Port	The TCP port of the Modbus slave with which you want to communicate. The default is 502.
Interval (sec)	How often the InsightCM device process reads the Modbus slave device, in seconds.
Read Timeout (sec)	How long the read process waits for a response from the Modbus slave device when initializing or reading from the device. If the Modbus slave device does not respond within the specified timeout, the InsightCM device attempts to re-open a connection after 30 seconds.

4.3. Modifying Device Communication and Configuration

Review, update, and configure your devices for your condition-monitoring needs.

Before you begin, add a Cutsforth monitoring device (page 31).

Complete any of the following tasks to customize your devices in InsightCM.

- Change Settings in Device Configuration (page 76)–Configure device settings, such as endpoint mappings, data groups, channel mappings, sample rate, and hardware configuration.
- Reintegrate Quarantined Endpoint (page 76)–Re-establish communication with an endpoint without rebooting the wireless gateway.
- Configure Units of Data (page 77)–Allow or restrict specific units for channels with a certain measurement type.
- Change Units to Metric (page 78)–Change measurement type units to metric.
- Update Device Software (page 78)–Review the application types and versions running on each device and update the application and firmware that the device runs.
- Review Detailed Device Information (page 80)–Review a summary of device information based on the most recently acquired sensor data.
- Learn about Device Property Configurations (page 81)–Learn how to fine-tune file transfer and network performance for wireless and CMS devices.
- Reset Device to Factory Settings (page 85)–Reset a device to its original application image.

Now that you have customized your devices in InsightCM, learn about and integrate a historian software.

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4.3.1. Changing Device Configuration Settings

Configure device settings, such as endpoint mappings, data groups, channel mappings, sample rate, and hardware configuration.

1. Click Configuration ( ) and select **Devices**.
2. Double-click a device to open its configuration page.
3. Configure the settings you want to modify using the tabs in this device's configuration page.

Mapping Device Channels and Data Groups (page 35)	Map each sensor to a device channel and put all sensors for one asset into a data group for which you can configure data collection behaviors.
Creating and Configuring Data Sources (page 72)	Configure a data source from external sources, such as a Modbus Register, an OPC UA Tag, or a Historian Input.
Device Property Configurations (page 81)	Learn how you can fine-tune file transfer and network performance for wireless and CMS devices.
Updating a Device's Hardware Configuration (page 76)	Update your device's configuration in the web application, including the placement of modules within chassis slots, to match the physical device.

4. Click **Back to Devices**.
5. Select the device you updated and click **Update Configuration** to apply the changes.

4.3.1.1. Updating a Device's Hardware Configuration

Update your device's configuration in the web application, including the placement of modules within chassis slots, to match the physical device.

1. Click the **Configuration** pull-down ( ) and select **Devices**.
2. Double-click the device whose hardware configuration you need to update and select the **Hardware** tab.
3. Click **Edit Hardware**.
4. Configure the IP address, controller type, and module arrangement as needed in the Edit Hardware dialog box.

> The module options for each slot may be limited according the slot place in the chassis.

4.3.2. Reintegrating Quarantined Endpoints

Re-establish communication with an endpoint without rebooting the MON-10496.

When an endpoint fails to communicate 5 times, the MON-10496 *quarantines* the endpoint, or ceases to attempt communication with the endpoint. Until you correct the cause of failure and re-establish communication, data is not collected from the quarantined endpoint.

Common reasons an endpoint fails to communicate:

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- The battery needs to be changed.
- There is a significant obstruction between the endpoint and the MON-10496.

1. On the main Dashboard, click **Wireless** to access the Wireless Dashboard.
2. Select the quarantined endpoint.
3. Click the **Action** menu (≡) and select **Clear Quarantine**.
4. Confirm that the endpoint's status changes and that communication with the endpoint has been re-established.

> It may take several minutes for the endpoint status to update. The MON-10496 to communicate with endpoints 5 times every 15 minutes before quarantining unresponsive endpoints again.

4.3.3. Adding or Removing Units of Data

Allow or restrict specific units for channels with a certain measurement type.

The default setting for units in the web application is imperial. Refer to Changing Measurement Type Units to Metric (page 78) to switch from imperial to metric.

> Each sensor type can have one or more allowed units. The units you allow for a sensor type also determines in what units InsightCM calculates features.

1. Click the **Navigation** menu (˅) and select **System > Units**.
2. Select a sensor type.
3. Click **Add Unit** or **Remove Unit** to specify what units each sensor type can use.

4.3.4. Supported Units

See the imperial and metric units for each measurement type.

Measurement Type	Imperial	Metric
Acceleration	g	m/s2
Current	amp	amp
Displacement	mil, volt, in	m, mm, micron
EMSA	uV	uV
Resistance	ohm	ohm
Speed	RPM	RPM
Temperature	F	C
Velocity	ips	m/s, mm/s
Voltage	volt	volt

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4.3.5. Changing Measurement Type Units to Metric

Change the measurement type units to metric.

Complete the following steps to switch to metric units.

1. Open a command prompt on the server machine and change to the following directory:

   ```
   C:\Program Files\Cutsforth\InsightCM\
   ```

2. Run the following command:

   ```
   InsightCMConsole.exe importdefinition -t unit -f "C:\ProgramData\Cutsforth\
   InsightCM\Definitions\UnitDefinitions\MetricUnits.json"
   ```

3. Check that the command prompt reports `"Success:"`.
4. Run the following command:

   ```
   InsightCMConsole.exe exportdefinition -t asset -n <sensor name>
   -o "<full path to output definition file>"
   ```

5. Open the definition file using a text editor.
6. Find the property definition where the key value is `Unit` and change the value of `DefaultValue` to the appropriate metric unit.
7. Save the file and run the following command:

   ```
   InsightCMConsole.exe importdefinition -t asset -f
   "<fullpath to definition file>"
   ```

8. Repeat steps 4 through 7 for each sensor definition you want to update.

4.3.6. Updating Device Software

Review the application types and versions running on each device and update the application and firmware that the device runs.

1. Click **Configuration** ( ) and select **Devices**.
2. Click the **Software** tab and select one or more online devices.

   The devices you select must be of the same type.

3. Depending on your updating goal, complete one of the following steps.

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Update the application on one or more devices to the latest version on InsightCM.	Click **Update Application**. ▪ This operation requires devices to reboot and might take several minutes to complete. ▪ The web application does not allow you to update applications for devices with a disabled connection status.
Verify the latest application is running on a device.	Compare the Configured Version and Latest Version columns in the device table to see if a more recent application version is available on the server.
Resolve persistent errors with the device operation. This step should only be taken with a recommendation from Cutsforth, as there may be solutions other than formatting the device.	Click the Action menu (≡) and select **Format Device**.

4.3.7. Upgrading Device Hardware

Upgrade your device hardware in InsightCM to match the device types that you have while keeping existing asset mappings intact.

1. Click **Configuration** ( ) and select **Devices**.
2. Select a device and click **Edit**.
3. Select the **Hardware** tab and click **Upgrade Hardware**.
4. Specify which device type you are upgrading to using the pull-down and click **OK**.

   Since **this action cannot be undone,** ensure that you are upgrading the correct device before confirming the change.

   The changes are applied automatically.
5. If the IP address of your upgraded device has also changed, click **Edit Hardware** to update that information.

4.3.8. Uploading or Removing Software Packages

Update the system image on your monitoring devices by uploading the new image versions to InsightCM and deploying the image to your devices.

Before you begin, download the version of the device image you wish to deploy.

To add or remove firmware versions from InsightCM, complete the following steps.

1. In InsightCM, click the Navigation menu ( ) and select **Utilities > Package Management**.
2. Click **Upload**, select the system image you wish to deploy to your devices, and click **Open**.
3. Select the outdated image(s) and click **Remove**.

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4. Click **Configuration** (˅) and select **Devices** to navigate to the Device Configuration page.
5. Select the **Software** tab.
6. Select one or more devices of the same toolkit and type.
7. Click **Update Application** to apply the new image.
8. Verify that the Deployment Status updates to Successful.

4.3.9. What Happens to Files When You Update Device Applications

When you update applications on a device, the device deletes log files (including the tracelog) and configuration files.

To manually retrieve any type of file from the device disk, Cutsforth recommends using WebDAV, a protocol that enables you to securely manipulate files on your target, to retrieve files. Files on the device are located at **`/home/lvuser/natinst/LabVIEW Data/InsightCM`**.

> For information about configuring WebDAV on a host computer and transferring files from the device, visit **`ni.com/info`** and enter the Info Code **`WebDAVTransfer`** to access the Cutsforth support document Using WebDAV to Transfer Files to Your Real-Time Target.

4.3.10. Review Detailed Device Information

Review a summary of device information from the most recently acquired sensor data.

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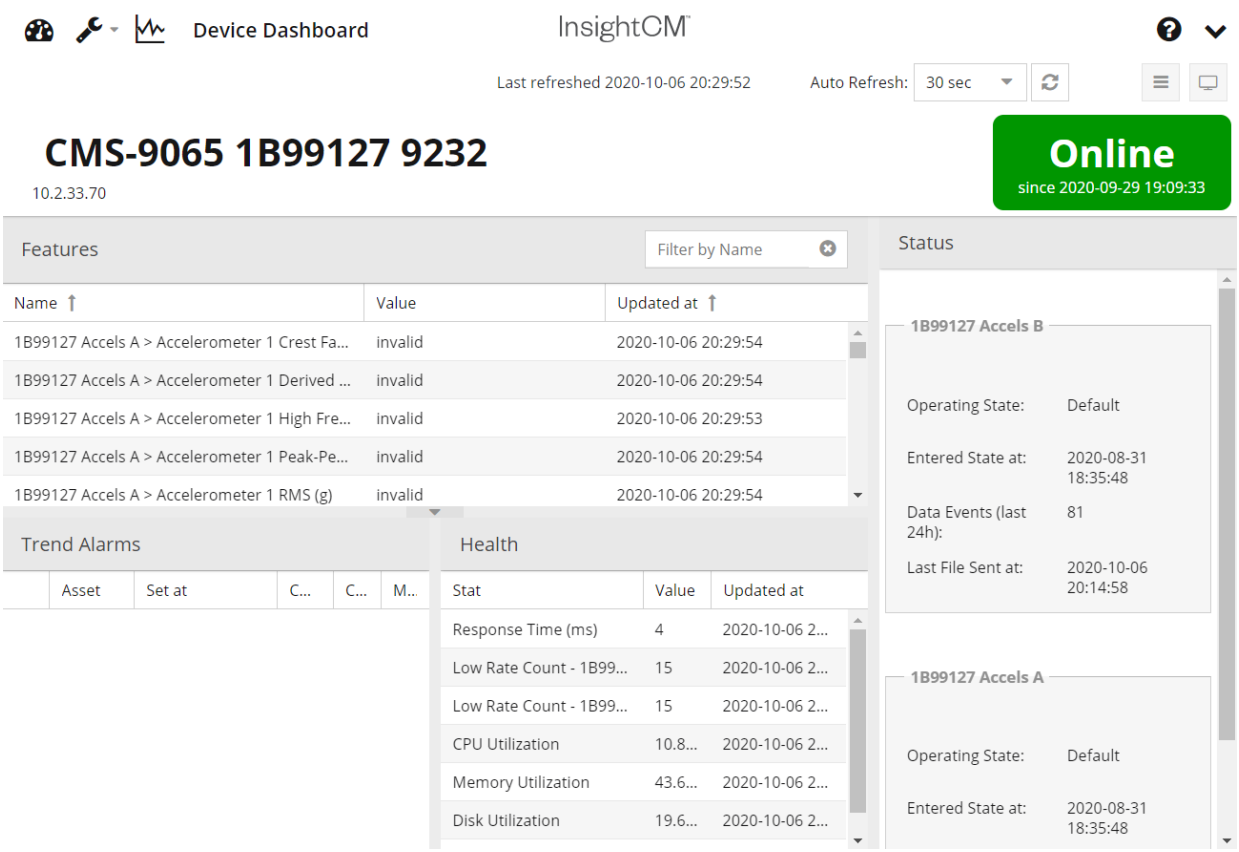

1. Click the **Configuration** pull-down ( ) and select **Devices**.
2. Watch data update while the device performs an acquisition, reboots, or you test its connection using the Action menu ( ).
3. Click the **View** menu ( ) to navigate to the Device Configuration page and update settings in a device's configuration.

   > The Features table updates only when data is available from a channel whose status is okay.

4. Click the **View** menu ( ) to navigate to the Device Health Dashboard page and evaluate the health of a device by viewing statistical data, including graphs of available memory, CPU usage, drive space, and the response time to pings, over a configurable time range.

4.3.11. Device Property Configurations

You can fine-tune file transfer and network performance for wireless and CMS devices using the following features.

Burst Mode - A mode that you can configure on a device to enable the manual or scheduled acquisition of high-resolution data.

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Sample Rate - You can configure the sample rate for channels on Cutsforth 923x modules only. Devices always sample from static channels on other module types at 1 Hz and for one second. For more information, refer to Frequently Asked Questions about Sample Rates and Durations (page 83).

Time Trigger Offset - An amount of time, in seconds, to delay time-based acquisitions. For example, if a device is configured to perform an acquisition daily at 1:00 PM, and the value of this property is 110 seconds, the device waits until 1:01:50 PM to perform the acquisition. This property is useful for spreading out network traffic when many devices are configured to perform acquisitions at a specific time of day.

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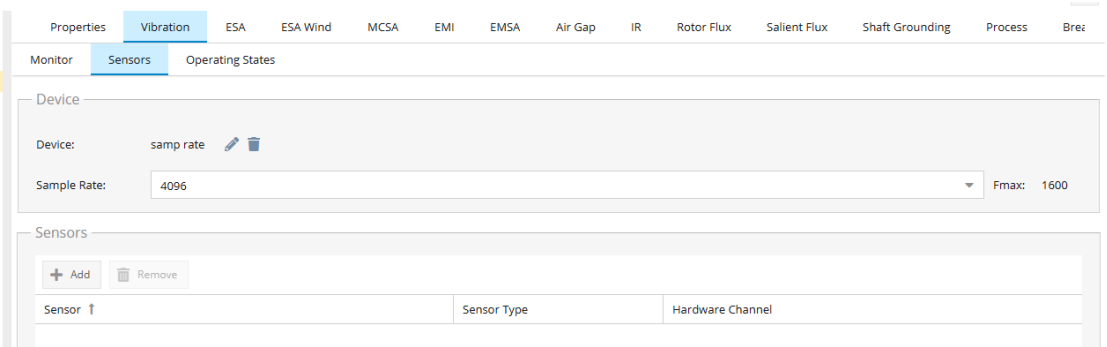
4.3.11.1. FAQs on Sample Rates and Durations

Q:	At what sample rate do devices acquire data?
A:	You can configure the sample rate for waveform channels on dynamic modules, such as the Cutsforth 9232, in the asset tree by navigating to the **Vibration** > **Sensors** tab and modifying it in the box shown below. However, devices always sample from channels that produce single-point values, such as voltage and temperature, at 1 Hz. If a device contains both types of channels, the device samples them at different rates. 
Q:	Can you configure unique sample rates or acquisition durations for each channel?
A:	No: ▪ All waveform channels on a device share the same configurable sample rate. ▪ All single-point channels are sampled at 1 Hz. If you must sample from two nearby sensors at different rates, consider using two different devices, each with a unique sample rate.
Q:	How do devices log single-point data during a multi-second acquisition?
A:	When a device contains both waveform and single-point channels, you configure the duration of acquisitions on the **Operating States** tab of the Asset Configuration page for the equipment the device is monitoring. However, devices always log only the final value from single-point channels. Consider the following example where a device acquires from one waveform channel and one single-point channel for four seconds.

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	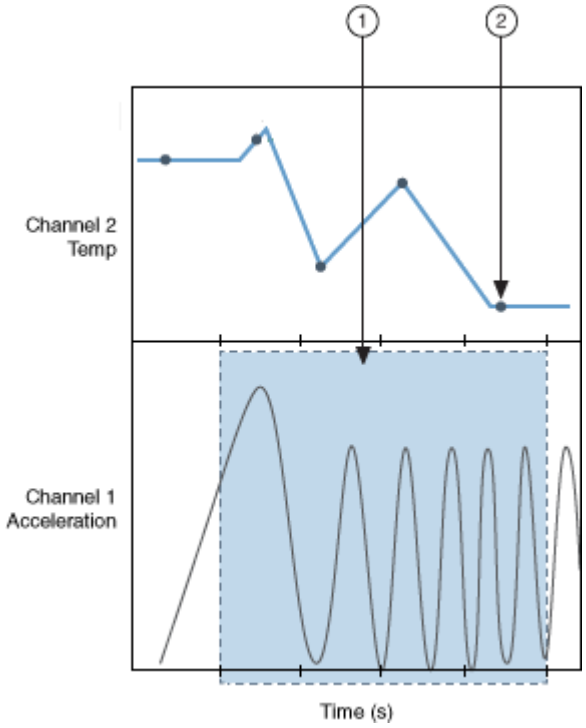
	1 The full, four-second acquisition. The device logs waveform data throughout the acquisition.
	2 The temperature value from the final second. This is the only temperature value the device logs from this acquisition.

4.3.11.2. MCSA Device Properties

The **Device Properties** tab contains a table of properties of the device sample rate and the minimum and maximum current RMS value for the device to calculate all the configured Motor (MCSA) asset features.

The following are built-in properties:

- Sample Rate—Sample rates of 5,000 Hz and 10,000 Hz are supported.
- Minimum Working Current (%FLA)—The minimum current RMS value of a motor for the device to calculate all the configured features (except Percent Full Load Amps) that belong to the Motor channel, as a percentage of the motor Full Load Amps. The default is 25%.
- Maximum Working Current (%FLA)—The maximum current RMS value of a motor for the device to calculate all the configured features (except Percent Full Load Amps) that belong to the Motor channel, as a percentage of the motor Full Load Amps. The default is 200%.

If the instantaneous current RMS of a motor is below **Minimum Working Current** or above **Maximum Working Current**, the device only calculates the Percent Full Load Amps feature. The Rotor Bar Sideband feature returns a -100 dB value and other non-calculated features return a zero value.

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4.3.12. Resetting a Device to Factory Settings

Reset a device to its original application image.

1. Click the **Configuration** pull-down ( ) and select **Devices**.
2. Select the **Software** tab.
3. Select a device.
4. Select the **Action** menu ( ) and select **Reset to Factory Default**.

4.4. Modifying an Asset Type

Modify properties, default feature sets, default trend alarm rules, data validation, and default fault frequency sets for all assets of a specific type.

1. Click the **Configuration** button ( ) and ensure that you are on the Asset Configuration page.
2. Click the Action menu ( ) and select **Edit Asset Definitions**.
3. Select the asset type that you would like to edit.
4. Select the tab within the asset type editor in which you would like to make changes.

- The web application will automatically save and apply edits you make to the properties or data validation tabs to all existing and future assets of this type in your asset tree.
- You need to select and toggle to default new or existing features to apply them to existing and future assets.

4.4.1. Editing the Behavior of an Asset Type

Edit how an asset type behaves in the web application.

1. Click **Configuration** ( ) to navigate to the Asset Configuration page.
2. Click the **Action** menu ( ) and select **Edit Asset Definitions**.
   - Enable operating state, speed reference, and streaming capabilities for an asset type.
     - Click the **Edit** button in the Capabilities field to see the configuration options for whatever capabilities are available for an asset type.
   - Define categories to describe an asset type.
     - Click the **Edit** button in the Categories field to display the Select Categories dialog box.
     - Add, remove, and reorder categories to describe the asset type.

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> The categories assigned to a definition determine which capabilities are available for that asset type.

- Define the kind of measurement you want the asset type to perform.
  - Place a checkmark in the Waveform or Single Point checkbox to indicate how you want the asset type to acquire data.
  - Use the Measurement Type listbox to specify the kind of measurement you want the asset type to perform.

> Note the kinds of measurements an asset of any type can perform are limited by the kind of channel to which the asset is assigned.

- Add, remove, or edit asset types derived from a source asset type.
  - Use the Local Definition Types section to specify the asset types you want to be derived from the source and how many instances of the derived asset type a user can create.

> Only asset types with Local Scope enabled appear in the Type listbox.

- Define a scheme for automatically creating unique names for derived assets when a user adds them on the Asset Configuration page.
  - In the Name Format field, enter a name that describes the asset type and include the variable `{0}` somewhere in the name.

> When a user adds an asset of this type, the web application automatically replaces `{0}` with the name of the source asset type. For example, if a user adds an asset type with a name format of `{0}` Double Integrated as a derived asset on an asset named `Main Accelerometer`, the web application automatically generates the name `Main Accelerometer Double Integrated`.

- Specify what label the web application displays for the derived asset type.
  - Enter a value in the Label that describes the derived asset type and differentiates it from other derived assets.

> This is the label that appears on the Properties tab of any instance of the source asset on the Asset Configuration page next to the button for adding or removing the derived asset.

4.5. Collecting Data

Update data collection configurations for assets according to your condition monitoring needs.

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Task	Description
Configuring Data Collection for Wireless Equipment (page 87)	Select the endpoint type, set the sample rate, acquisition length, collection time(s), gate source, and sensors associated with the device.
Configuring Collection Conditions for Thermal Imaging Devices (page 87)	Specify how often the device collects data, a delta EU trigger, or an advanced collection condition.
Deactivating Sensors (page 88)	Shut off data collection for sensors.
Disabling Assets (page 88)	Shut off data collection for an asset and all child assets.

4.5.1. Configuring Data Collection for Wireless Equipment

Configure data collection behaviors for your wirelessly monitored asset.

1. Click **Configuration > Assets**.
2. Select a wirelessly monitored equipment asset.
3. Select the **Collection** tab.
4. Select the endpoint type using the pull-down in that section.
5. Configure Sample Rate and Acquisition Length using the text fields.

   These settings may affect the wireless gateway device's data acquisition and battery life performance.

6. Use the **Collect At** pull-down to define the time(s) you want your device to collect data.
7. (Optional) To change the gate source, click the **Edit** button near Gate and click the **Edit** button within the Select Gate Source dialog box.

   You can only select the features for each sensor asset within the wirelessly monitored equipment.

8. (Optional) Use the **Compare To** spin box to configure a feature value, then click **OK**.

   If the feature data falls below the Compare To value, no data will be collected.

9. Choose when and how often to retry the acquisition if the gate condition is not met.
10. Under **Sensors**, click **Add** to add sensors associated with the equipment you want to monitor.

    If a sensor is not listed here, you cannot map them on the sensor mapping page.

4.5.2. Configuring Collection Conditions for Thermal Imaging Devices

Collection conditions are evaluated on the thermal imaging device to determine when to send data sets and trend points to the server.

Complete the following steps to specify when a device collects camera data.

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1. Click **Configuration** ( ) and ensure you are on the Asset Configuration page.
2. Expand the **Action** menu ( ) and select **Cameras**.
3. Select a camera from the list in the Cameras dialog box and select **Data Collection**.
4. Configure the **Time**, **Delta EU**, and/or **Advanced** conditions as needed.

> After you configure the device, cameras, ROIs, and collection conditions, you must notify the device that the configuration has been changed. Select the device from the list of devices on the **Devices** tab of the Device Configuration page and click **Update Configuration**.

4.5.3. Deactivating a Sensor

Shut off sensor data collection to minimize the collection of erroneous data due to a faulty sensor.

1. Click **Configuration** ( ).
2. Locate the sensor you need to deactivate.
3. Right-click the sensor and select **Deactivate**.

   A notification pops up and the sensor should have a red marking to indicate when you successfully deactivate a sensor.
4. Repeat steps 2 and 3 as needed.

4.5.4. Disabling Assets

Shut off data collection for assets (including child assets and sensors) to minimize the collection of erroneous data.

1. Click **Configuration** ( ).
2. Locate the asset you need to disable.
3. Right-click the asset and select **Disable**.

   A notification pops up and the asset should have a red marking to indicate when you successfully disable an asset.

   > Child assets or sensors of the disabled asset also do not collect data though they are unmarked.
4. Repeat steps 2 and 3 as needed.

4.6. Adding Bearings or Fault Frequency Groups to an Asset

Configure the web application to note known frequencies that are problematic on the Asset Configuration page.

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1. Click **Configuration** ( ) and ensure you are on the Asset Configuration page.
2. Right-click on an asset and select **Add fault frequencies** to add the Fault Frequencies tab to your asset's configuration panel.
3. Click **Add** in the Bearings section.

Select a bearing from the database.	1. Find and select the bearing you want to add. 2. Click **OK**.
Create a new bearing.	1. Click the **Action** menu ( ) and select **Create**. 2. Provide a unique name to the bearing. 3. Provide values for FTF, BSF, BPFO, and BPFI. 4. Click **OK**. 5. Find and select the bearing you created. 6. Click **OK**.

4. Create fault frequency groups to define a set of fault frequencies to refer to by name.
   - Click **Add** in the Fault Frequency Groups section.

Select a fault frequency group from the database. No fault frequencies will be found the first time you add a fault frequency group.	1. Find and select the fault frequency group you want to add. 2. Click **OK**.
Create a new fault frequency group.	1. Click the **Action** menu ( ) and select **Create**. 2. Provide a unique name to the fault frequency group. 3. Click **Add**. 4. Provide a unique name for the fault frequency. 5. Select the type of frequency. 6. Designate what level the frequency is. 7. Click **OK**. 8. Repeat steps 3–7 to add new fault frequencies as needed. 9. Click **OK**. 10. Select the fault frequency group you created and click **OK**.

4.7. Assigning Features to Sensors

Specify what features you want an asset to calculate.

1. Click **Configuration** ( ) and select a sensor-level asset.

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2. Click the **Features** tab in the asset's configuration panel.

> This tab is available only on sensors that produce data sets.

3. Click **Add**.
4. Select one or more features in the Add Features dialog box and click **OK**.
5. Define what feature property is calculated for an asset by selecting a feature.

> Not all features have properties to edit.

6. Click **Edit** to display the Properties dialog box for that particular feature.
7. Configure any properties you want to and click **Close**.

> If you do not see the feature you want to add, you may need to add the feature on the Asset Definition (page 91) page.

4.7.1. Defining Feature Options for Sensors

Define which features are appropriate and available by creating a default set of features for the server to automatically assign to each sensor type.

Complete the following steps to review the predefined sets of features in the web application and to make changes at the system or asset level.

> You can also manually assign additional features that are not part of a sensor's set of features.

1. Click **Configuration** ( ) and ensure you are on the Asset Configuration page.
2. Click the **Action** menu ( ) and select **Edit Asset Definitions**.
3. Select the sensor for which you want to add a feature.
4. Click the **Features** tab in the definition panel.

> Some items in the features list have **Yes** in the Default column to indicate the items are predefined features. Features can have their default setting toggled to **Yes** so that all new sensors will have that feature. Removing the toggled default setting does not remove features from existing sensors.

5. Click the **Add** button and a dialog box will prompt you to select from additional features you can assign to the asset definition.

> If the dialog box is empty, no additional features are available.

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6. Select one or more features to add to an asset definition and click **OK**.
7. To push the added feature to future instances of this sensor type, highlight the feature list and click the **Toggle Default** button.
8. Add to the features available in the system.
   a. Click the **Navigation** menu.
   b. Hover over **System** and select **Features**.
   c. Click **Add** and hover over or select the type of feature you would like to add to the system.
   d. Enter a name and parameters for a new feature in the resulting dialog box and click **OK**.

> Any features you add to the system will be identifiable by the user glyph.

4.8. Batch Editing Assets

InsightCM allows users to edit multiple assets at one time using an exported spreadsheet.

Complete the following steps to update an exported asset spreadsheet and apply the changes to the asset tree in the web application:

1. In the navigation bar at the top of the page, click **Configuration** ( ) to navigate to the Asset Configuration page.
2. Click the **Action** menu ( ) and select **Import/Export » Export Asset Spreadsheet**. You can choose to export the entire asset tree or only the section you have selected.
3. Navigate to the exported spreadsheet on your computer and open it.
4. Fill out the relevant sections (page 91) in the spreadsheet.
5. Save the file after you have finished making changes.
6. Back on the Asset Configuration page, click the **Action** menu ( ) and select **Import/Export » Import Asset Spreadsheet** to display the **Import Asset** dialog box.
7. Click the **Browse** button ( ) to select the exported spreadsheet from your computer and apply your changes to the asset tree.

4.8.1. Asset Definition Spreadsheets

InsightCM allows users to edit multiple assets at one time using an exported spreadsheet.

	A	B	C
1	FullName	PropertyName	PropertyValue
2	NI|Austin|Mopac C|Central Plant|CWP P-1|Chilled Water Pump P-1	NominalSpeed	1175
3	NI|Austin|Mopac C|Central Plant|CWP P-1|Chilled Water Pump P-1	SmpId	NI|Austin|Mopac C|Central Plant|CWP P-1
4	NI|Austin|Mopac C|Central Plant|CWP P-1|Chilled Water Pump P-1	SmpKey	Pump
5	NI|Austin|Mopac C|Central Plant|CWP P-2|Chilled Water Pump P-2	NominalSpeed	1175
6	NI|Austin|Mopac C|Central Plant|CWP P-2|Chilled Water Pump P-2	SmpId	NI|Austin|Mopac C|Central Plant|CWP P-2

Info | AssetNodes | AssetNodeProperties | OperatingStates | OperatingStateProperties | Triggers | TriggerConditions | Features | Fea

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Asset spreadsheets contain the following tabs with their respective columns:

- AssetNodes—The settings that determine the functionality of an asset.
  - FullName—The full path to the asset in the asset tree with each level separated by pipes. For example,

    `Location|Equipment|Accelerometer`
  - Type—The name of the asset type, such as `Accelerometer`, `Tachometer`, or `true`.
  - Disabled—Disables the asset if set to `true`.
  - MeasType—Indicates whether the asset acquires data as a waveform or a single point and what type of measurement you want the asset to perform. For example,

    `Waveform|Tachometer`
  - Categories—Categories that describe the asset type and determine what capabilities are available for the asset type, such as `Dynamic`, `RotatingEquipment`, or `Accelerometer`.
- AssetNodeProperties—The properties that are available for an asset.
  - FullName—The full path to the asset in the asset tree with each level separated by pipes. For example,

    `Location|Equipment|Accelerometer`
  - PropertyName—The name that the InsightCM web application displays for the property.
  - PropertyValue—The value you want the InsightCM web application to set for the property when you import the spreadsheet.
- OperatingStates—The operating states that are available for an asset.
  - FullName—The full path to the asset in the asset tree with each level separated by pipes. For example,

    `Location|Equipment|Accelerometer`
  - Name—The name of the operating state that the InsightCM web application displays.
- OperatingStateProperties—The properties an operating state has when it is assigned to a specific asset.
  - FullName—The full path to the asset in the asset tree with each level separated by pipes. For example,

    `Location|Equipment|Accelerometer`
  - OperatingState—The operating state to which the property defined in this row applies.
  - PropertyName—The name of the property that the InsightCM web application displays.
  - PropertyValue—The value you want the InsightCM web application to set for the property when you import the spreadsheet.
- Triggers—The triggers that are available on an operating state assigned to a specific asset.
  - FullName—The full path to the asset in the asset tree with each level separated by pipes. For example,

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`Location|Equipment|Accelerometer`

- OperatingState—The name of the operating state to which the property applies.
- Type—The kind of trigger you want to configure. For example,

  `EnterTrigger`
- Expression—The expression or combination of expressions required to activate the trigger.

- TriggerConditions—The trigger conditions that are available for each trigger on an operating state assigned to a specific asset.
  - FullName—The full path to the asset in the asset tree with each level separated by pipes. For example,

    `Location|Equipment|Accelerometer`
  - OperatingState—The name of the operating state to which the trigger condition applies.
  - TriggerType—Which trigger the condition applies to.
  - Type—Specifies whether the trigger is time-based, such as- `Cron`, `Timespan`, or `Trend`.
  - Source—The feature that determines a feature-based trigger.
  - Operator—How the InsightCM web application compares the trend value to the compare value (For example, `Greater than` or `Equal to)`.
  - CompareTo—The value that the InsightCM web application compares the trend value to.
  - DwellSeconds—How long the trigger condition must be true before the InsightCM web applications activates the trigger.
- Features—The features that are available for an asset.
  - FullName—The full path to the asset in the asset tree with each level separated by pipes. For example,

    `Location|Equipment|Accelerometer`
  - Feature—The name of the feature that the InsightCM web application displays.
- FeatureProperties—The properties a feature has when assigned to a specific asset.
  - FullName—The full path to the asset in the asset tree with each level separated by pipes. For example,

    `Location|Equipment|Accelerometer`
  - Feature—The name of the feature to which the property applies.
  - PropertyName—The name of the property that the InsightCM web application displays.
  - PropertyValue—The value you want the InsightCM web application to set for the property when you import the spreadsheet.
- TrendAlarmRules—Alarm rules for features assigned to a specific asset.
  - FullName—The full path to the asset in the asset tree with each level separated by pipes. For example,

    `Location|Equipment|Accelerometer`

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  - Id—The string that other sections of the spreadsheet use to reference the alarm rule.
  - TrendName—The name of the feature to which the alarm rule applies.
  - Operator—How the InsightCM web application compares the trend value to the compare value. For example, `Greater than` or `Equal to`.
  - OperatingState—The operating state or states to which the alarm rule applies.
  - Hysteresis—An offset from the set point whose value causes InsightCM Server to clear the alarm when crossed.
  - OnDelaySeconds—The amount of time, in seconds, the set point must remain crossed before InsightCM Server sets the alarm.
  - OffDelaySeconds—The amount of time, in seconds, the hysteresis level must remain crossed before InsightCM Server clears the alarm.
  - AutoConfigCalc—Specifies whether to automatically configure levels from baseline values.
  - Disabled—Disables the alarm rule when set to `true`
- TrendAlarmLevels—How alarm levels are calculated for specific alarm rules.
  - RuleId—A string that specifies which alarm rule the level applies to.
  - Severity—The urgency of the level.
  - CompareTo—The value that the InsightCM web application compares the trend value to.
  - AutoConfig—Specifies whether to automatically configure levels from baseline values.
- AlarmActions—Specifies whether the InsightCM web application takes any action when a specific alarm is set.
  - AlarmId—A string that specifies which alarm rule the action applies to.
  - Severity—The urgency of the alarm level.
  - ActionName—A name that distinguishes this action from others.
  - Type—Specifies whether to send an email notification when the alarm is set.
- AlarmActionProperties—The action the InsightCM web application takes when a specific alarm is set.
  - AlarmId—A string that specifies which alarm rule the action applies to.
  - Severity—The urgency of the alarm level.
  - ActionName—The name of the action the property applies to.
  - PropertyName—Specifies whether this property specifies an address group or an email template.
  - PropertyValue—A string that specifies a particular address group or email template.
- SpectralAlarmRules—Spectral alarm rules for features assigned to a specific asset.
  - FullName—The full path to the asset in the asset tree with each level separated by pipes. For example,

    ```
    Location|Equipment|Accelerometer
    ```
  - Id—The string that other sections of the spreadsheet use to reference the alarm rule.
  - OperatingState—The operating state or states to which the alarm rule applies.
  - Unit—Specifies the units used to measure sensor data on the asset the sensor monitors.

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  - Integration—Specifies the type of integration, if any, to apply to asset data to check for this rule.
  - Cutoff—Specifies the frequency, in Hz, for the highpass filter when performing double integration on asset data.
- SpectralAlarmLevels—How alarm levels are calculated for specific spectral alarm rules.
  - RuleId—A string that specifies which alarm rule the level applies to.
  - Severity—The urgency of the level.
  - CompareTo—The value that the InsightCM web application compares the trend value to.
- SpectralAlarmActions—Specifies whether the InsightCM web application takes any action when a specific spectral alarm is set.
  - AlarmId—A string that specifies which alarm rule the action applies to.
  - Severity—The urgency of the alarm level.
  - ActionName—A name that distinguishes this action from others.
  - Type—Specifies whether to send an email notification when the alarm is set.
- SpectralAlarmActionProperties—The action the InsightCM web application takes when a specific spectral alarm is set.
  - AlarmId—A string that specifies which alarm rule the action applies to.
  - Severity—The urgency of the alarm level.
  - ActionName—The name of the action the property applies to.
  - PropertyName—Specifies whether this property specifies an address group or an email template.
  - PropertyValue—A string that specifies a particular address group or email template.
- FaultFrequencies—Known frequencies that are problematic for an asset so that the InsightCM web application notes them on the Data Viewer page.
  - FullName—The full path to the asset in the asset tree with each level separated by pipes. For example,

    ```
    Location|Equipment|Accelerometer
    ```
  - Name—A unique name for the fault frequency.
  - Type—Specifies whether the fault level is in orders or frequency.
  - Level—The fault level.
- NamedGroups—The name of a group of fault frequencies assigned to an asset.
  - FullName—The full path to the asset in the asset tree with each level separated by pipes. For example,

    ```
    Location|Equipment|Accelerometer
    ```
  - Type—Enter

    ```
    fault frequencies
    ```

    as the value for this column.
  - Name—A unique name for the fault frequency group.

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4.8.2. Batch Updating Device Configurations with a Device Spreadsheet

Edit batch configurations in a device spreadsheet to make updates to multiple devices that you already configured in the web application.

1. Click **Configuration** ( ) and select **Devices**.
2. Select the device(s) you want to update.
3. From the Action menu ( ), hover over **Import/Export**, select **Export Devices Spreadsheet**, and then choose whether to export configurations for devices you selected in step 2 or all devices.
4. The web application downloads a spreadsheet file to your computer. Create a copy of the downloaded file. If you introduce errors while editing the spreadsheet and then import the errors, you can then import the copy, which allows you to return device configurations to a working state.
5. Open the .xlsx device spreadsheet file.

   > The spreadsheet contains several worksheets that define different types of device-configuration properties. The spreadsheet links related properties in separate worksheets via the names in the spreadsheet. For example, the Channels worksheet identifies which data group owns the channels by specifying the data group name as defined on the DataGroups worksheet.

6. Edit the properties of interest in the spreadsheet. For example, you might want to change the sample rate on multiple devices at the same time.
7. To apply your changes to the device configurations in the web application, return to the Device Configuration page, and select import the device spreadsheet from the Action menu ( ).

4.9. Validating Sensor Data

Ensure that sensors are returning valid data.

Ensure that sensors are returning valid data. Review data validation errors on the Notifications page.

1. Click the **Navigation** menu ( ) and select **System > Asset Definitions**.
2. Choose and complete one of the tasks below for an asset type according to how you need your sensor data validated.
   - Enable data validation rule options.
     1. Ensure that the Data Validation checkbox is enabled.
   - Set a rule to check that waveform values are within a specified range.
     1. Ensure that the Range Check checkbox is enabled.
     2. Use the Maximum EU and Minimum EU fields to specify a range of acceptable values. See Difference Between Range Check and Input Range (page 97) for more information.
   - Set a rule to check that consecutive waveform values do not remain the same for more than the specified number of samples.

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1. Ensure that the N Rule checkbox is enabled.
2. Use the Maximum Samples field to specify the maximum number of consecutive samples for which waveform values can remain the same.

- Set a rule to check that consecutive waveform values do not have the same sign for more than a specified amount of time.
  1. Ensure that the Z Rule checkbox is enabled.
  2. Use the Maximum Time field to specify the maximum amount of time that consecutive waveform values can have the same sign.
- Set a rule to ensure that all waveforms have a minimum percentage of unique values.
  1. Place a checkmark in the U Rule checkbox.
  2. Use the Minimum Percent field to specify the minimum percentage of unique values for a given waveform.
- Set a rule to check that the ratio of the Peak feature to the Peak-Peak feature is within the range you specify.
  1. Ensure that the Pk/Pk-Pk checkbox is enabled.
  2. Use the Minimum Ratio and Maximum Ratio fields to specify a range of acceptable peak ratio values.
- Set a rule to check for a suspect amount of energy at line frequency.
  1. Place a checkmark in the Line Noise checkbox.
  2. Use the Line Frequency field to specify the line frequency.

     The InsightCM Server does not apply this rule if the running speed is within 20% of the specified line frequency.
- Set a rule to check for waveforms with low RMS levels.
  1. Ensure that the Low Signal checkbox is enabled.
  2. Use the Maximum RMS field to specify the highest acceptable RMS value.
- Set a rule to check for too much low frequency energy.
  1. Ensure that the Ski Slope checkbox is enabled.

4.9.1. Difference Between Range Check and Input Range

The Range Check: Minimum and Range Check: Maximum properties are the minimum and maximum values you expect to measure after any scaling. These values are sometimes confused with the Input Range property. Input Range refers only to the input range of a particular device, in the pre-scaled units the device measures. For example, the Input Range for a module might be 0 to 10 V, but that module might be used with a temperature sensor that outputs 100 mV for every 1 °C. The Range Check: Minimum and Range Check: Maximum in that case could be 0 to 100 V, with 10 V corresponding to 100 °C.

In this example, you could set the Custom Scale: Slope property to 0.01 to implement the conversion from V to °C.

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4.9.2. Audit Logger Tab on System Page

The server logs errors and certain events, such as when services start and when an asset is updated.

Ensure that you are on the Audit Logger tab of the System page by clicking the **Navigation** menu, hovering over **Utilities**, and selecting **Audit Logger**.

By default, only the last 30 days of events are retained on the server. You may filter the data events by clicking the **Filter By...** button, or by clicking header of each column to automatically filter in ascending order.

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5. Viewing Data

Access collected data in InsightCM™ and use different chart viewers for closer analysis of outlying measurements.

- Viewing Trend Data (page 99)–View trend data for the features calculated on the device.
- Watching a Live Stream (page 104)–View streams from all equipment or from one equipment as streams begin.
- Loading Historical Streams (page 105)–Load streams that are stored in the server and view them on the Data Viewer page.
- Deleting Data (page 120)–Delete data you no longer need but that the server retained to conserve space and memory.
- Creating a Trend Baseline (page 123)–Trend baselines determine the values that InsightCM uses to create trend alarms.
- Viewing Historical Data (page 124)–Analyze historical periodic data by loading a feature in the Trend viewer and then loading the data set in a waveform, spectrum, or other sensor data viewer.
- Comparing Measurements from Different Sources or Times (page 126)–Compare measurements from multiple points in time or from multiple pieces of equipment by creating data event references that you can show in a chart later.

5.1. Viewing Trend Data

View trend data for the features calculated on the device.

Ensure that you have collected data from your equipment.

1. Click the **Data Viewer** ( ) button in the navigation bar,
2. In the asset tree, locate one of the sensors you added to monitor your equipment and expand it.

   The asset tree should now contain features nested under each sensor.
3. Click a feature in the asset tree. The trend viewer in the top window populates with trend data for that feature.
4. Click the **Annotate Data Sets** button in the Trend Chart and double-click above or below a data set.

   The other two viewer charts will automatically populate waveform and spectrum data.

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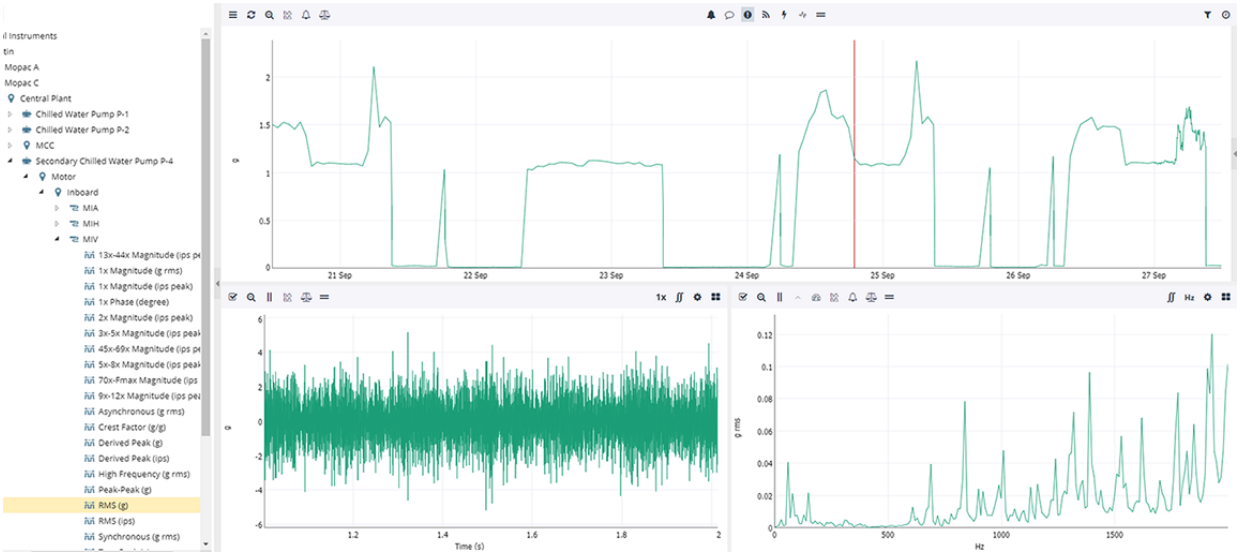

5.2. Parts of the Data Viewer

The Data Viewer page is a customizable environment with components that provide access to data and a workspace that contains charts, or *viewers*. You can add and remove different viewers, load historical or live data, and use various tools to examine features of interest in more detail.

The following image is an example of the Data Viewer page.

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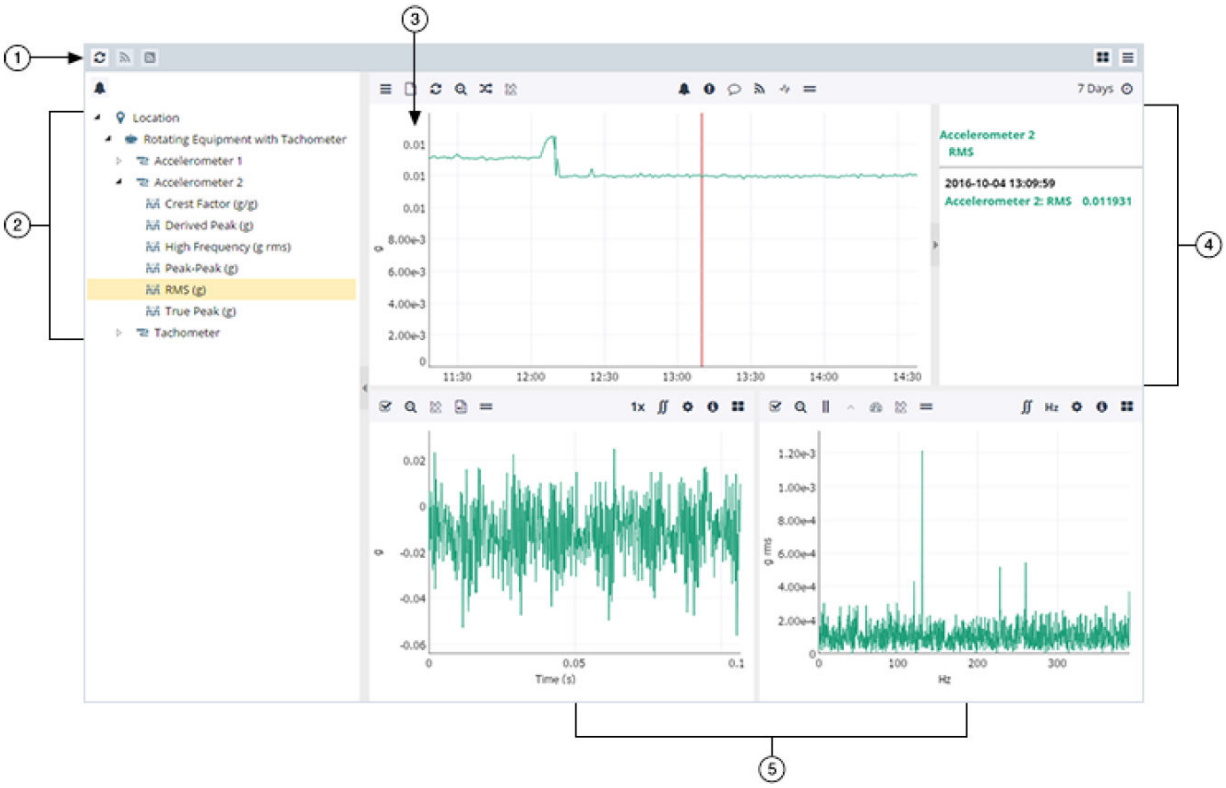

1	Data Viewer Toolbar
2	Asset tree
3	Trend viewer
4	Metadata pane
5	Viewers with sensor data

5.2.1. Operating Modes

The Data Viewer page has two operating modes designed for viewing specific types of data:

- Periodic Data—Data trends over a customizable time range.
- Stream Data—Live or historian data acquired continuously during an operating state, such as run-up or coast-down. The time range for which you can access data is restricted to the duration of the operating state.

To provide a starting point for your analysis tasks, both modes have a default layout of viewers and a customized toolbar for working in that mode.

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5.2.2. Switching between Periodic and Stream Data Modes

To load stream data or subscribe to a stream, view the Data Viewer page in Stream Data mode.

When the Data Viewer page is in Stream Data mode, switch to Periodic Data mode by clicking the **Switch to periodic view** button on the Data Viewer page toolbar.

5.3. Streams of Data

Cutsforth monitoring devices, such as Condition Monitoring Systems (CMS), are designed to detect when a piece of equipment enters a particular state of behavior, and then collect and group a series of data files until the equipment reaches a steady state. For example, a device detects that a turbine begins a run-up when the speed measured by a tachometer increases to above 200 RPM; it then enters an operating state in which it collects and groups files. When devices group files in this way, the resulting files are referred to as a stream. The Data Viewer page provides several features for displaying data that has been acquired as part of a stream.

5.3.1. Introduction to Streams

A stream is a single entity that combines many measurements from one device for the purpose of visualizing the data as a group. This is useful because by interacting with a single stream, you can quickly view all data the device acquired when the equipment was experiencing the behavior of interest. In the case of run-ups and coast-downs, where speed measurements cause a data group to enter a stream-enabled operating state, a stream contains the trend of speed measurements throughout the run-up or coast-down, as well as data from each sensor in the data group.

5.3.2. How Streams Work

The following steps describe the actions that occur during a stream-enabled operating state to produce a stream:

1. A device detects when a speed condition is met and starts collecting files. For example, a device detects a run-up when the speed increases to above 200 RPM; it then starts a cycle of collecting ten seconds of data, waiting for fifteen seconds, and then repeating.

   > Users configure stream settings on a per-equipment basis on the **Properties** tab of the Asset Configuration page.
   >
   > Streams can only be triggered on the Speed Feature of an Asset.

2. InsightCM Server receives data from the device and makes the data available for viewing on the Data Viewer page.

   > On the Data Viewer page, you can subscribe to the stream to update viewers with live data. See Watching a Live Stream (page 104).

3. The device detects the stop condition that indicates the equipment reached a steady state, and then stops performing stream acquisitions.

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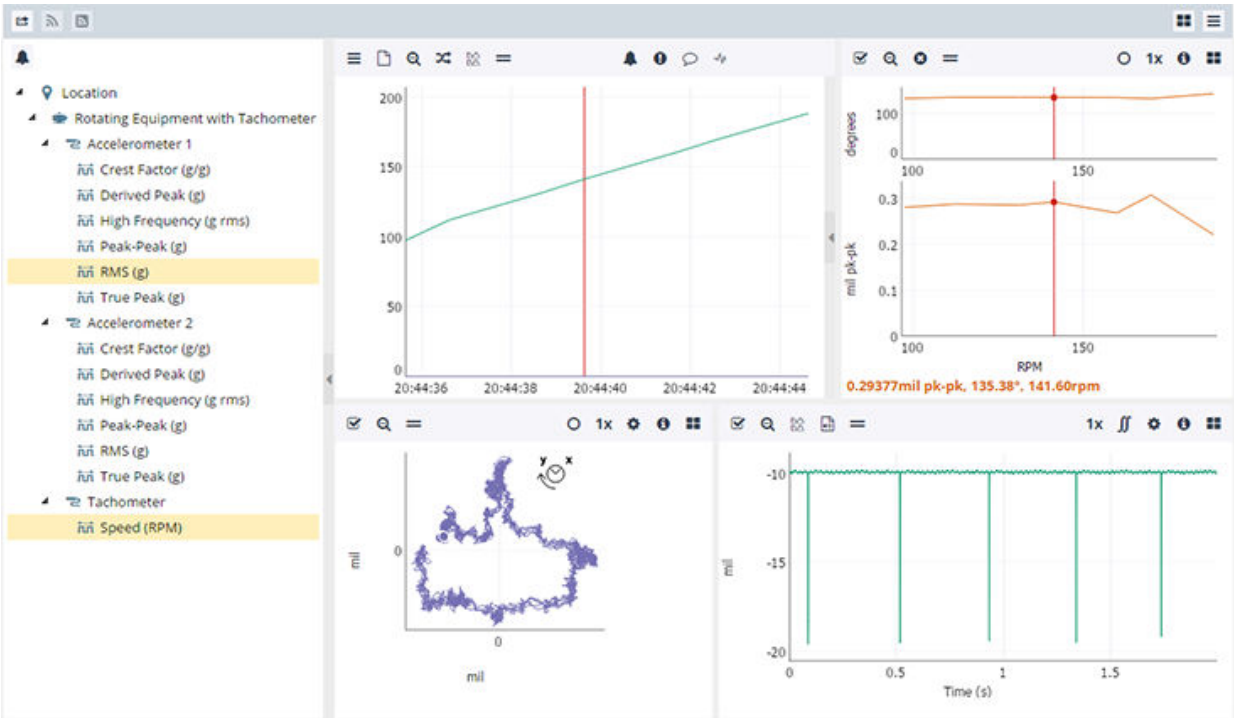
4. On the Data Viewer page, you can load the stream of data that the server created.

The following illustration shows the role of each component.

5.3.3. Run-Up Example

The following workspace shows the Data Viewer page with a run-up stream loaded. Notice the following characteristics:

- The workspace is in continuous-data mode.
- The Trend Viewer contains a single trend of speed values from the tachometer whose measurements indicate a run-up and trigger stream acquisitions.
- The Trend Viewer time axis is restricted to the duration of the run-up. In other words, you cannot adjust the time range to show other historical measurements that occurred before or after the run-up.
- Other viewers contain measurements from several different sensors.
- If you place a cursor in the Trend Viewer and move it with the arrow keys, the data in the other viewers will update to match the timestamp of the Trend Viewer.



5.3.4. Behavior when Devices Monitor Multiple Pieces of Equipment or Multiple Devices Monitor the Same Equipment

Streams consist of all the data that sensors on a specific data group acquire. A data group is a set of channels mapped to sensors that monitor the same piece of equipment. Data groups are useful in

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situations where a single device connects to sensors on multiple pieces of equipment whose data you want to acquire according to different parameters.

If a device monitors two pieces of equipment, each with unique operating behaviors, ensure the pieces of equipment belong to separate data groups. Otherwise, if the data group experiences an enter condition that is relevant for only one piece of equipment, the device includes data from the second piece of equipment as part of the stream.

5.3.5. Streams versus Periodic Acquisitions

Data streams are similar to periodic acquisitions in the following ways.

- The InsightCM Server stores both types of data.
- The Trend Viewer displays values from both types of acquisitions.

Streams differ from periodic acquisitions in the following ways:

- Users can configure a device to continuously collect files at intervals of only a few minutes or delta EUs when it enters a stream-enabled operating state. However, periodic acquisitions might occur much less frequently, such as only when a time interval elapses or a delta EU or alarm condition evaluates true.
- Separate aging rules apply to stream and periodic data files.

5.4. Watching a Live Stream

View streams from all equipment or from one equipment as streams begin.

When a stream-enabled operating state is in progress, data viewers can display live trends and measurements as devices acquire data from equipment. Choose one of the following ways to begin viewing a stream.

1. Click the **Data Viewer** ( ) button.
2. Determine how you want to view a stream.
   - See when any of the equipment you have configured on the Asset Configuration page starts a stream.
     1. Above the asset tree, click the **Load Stream** button.
     2. In the Load Stream dialog, click **Available Streams**.
     3. Select an item to start updating viewers with data acquired from the equipment.
   - To view a stream from a particular equipment asset, complete the following steps.
     1. Click the **Subscribe to Stream** ( ) button to allow all viewers to update with live data.

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If necessary, the Data Viewer page automatically switches to Stream Data mode so you can access viewers and other features that are useful for analyzing stream data. When a stream begins, the viewers automatically begin updating with data. If a stream is not in progress, the viewers remain empty. The **Subscribe to Stream** button is disabled until you select a piece of equipment with a stream-enabled operating state in the asset tree.

5.4.1. Periodic and Stream Acquisitions

The InsightCM Server treats data acquisitions differently depending on whether they occur during any stream-enabled operating state, such as a run-up or coast-down. Any acquisition that is not part of a stream is categorized as a periodic acquisition. The following table describes some of the differences between periodic and stream acquisitions.

Acquisition Category	Triggers	Where to Configure	Data Storage
Periodic	▪ Time interval ▪ Delta EU ▪ Alarm set or cleared ▪ Force trigger	Operating States tab on the Asset Configuration page	Stored in a single data set.
Stream	run-up or coast-down	Operating States tab on the Asset Configuration page	Stored in multiple data sets.

5.5. Loading Historical Streams

Load streams that are stored in the server and view them on the Data Viewer page.

In Stream Data mode, you can load streams of data that occurred in the past and are stored in InsightCM. Complete the following steps to load a previously acquired stream.

1. Click the **Data Viewer** ( ) button.
2. Click **Load Stream** ( ) to view a list of previously recorded streams for each piece of equipment in the asset tree.
3. Select a piece of equipment from the tree on the left to load available streams for that equipment.
4. In the list of streams that populates on the right side of the dialog box, select the stream of interest and click **OK**.

If necessary, the Data Viewer page automatically switches to Stream Data mode so you can access viewers and other features that are useful for analyzing stream data. When a stream begins, the viewers automatically begin updating with data. If a stream is not in progress, the viewers remain empty. The **Subscribe to Stream** button is disabled until you select a piece of equipment with a stream-enabled operating state in the asset tree.

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When you load a stream, you can perform the same tasks you use to analyze data in periodic data mode.

5. Move the cursor through the Trend Viewer point by point. By default, the Trend Viewer loads the speed feature from the tachometer that detected the stream-enabled operating state.
6. Watch the timestamp and cursor value update in the metadata pane.
7. Analyze data from all supported sensors in various viewers, even if the sensors are not loaded in the Trend Viewer.

> You cannot load trends from assets that are not part of the stream.
>
> The time range in viewers is restricted to the duration of the stream you load, so you cannot see additional data even from equipment that is part of the stream.

5.6. Viewers

Viewers contain charts in which you analyze data from sensors as well as trends in features calculated from sensor data.

For example, Waveform is sensor data of acceleration values from an accelerometer, and the RMS value is a feature for which you can calculate trends from the waveform. The workspace provides viewers for both waveform and trend data.

- Trend viewer—Displays trends in features over time. The workspace always contains a single Trend viewer in the top row.
- Sensor data viewers—Display raw sensor data as waveforms, spectrums, orbits, and other sensor data types. The workspace can contain as many or as few sensor data viewers as you want.

Relationship Between Feature Trends and Sensor Data

> The peak may not be a point represented on the graph because it may fall between two recorded points.

The callout numbers on the following workspace show the relationship between sensor data and trends.

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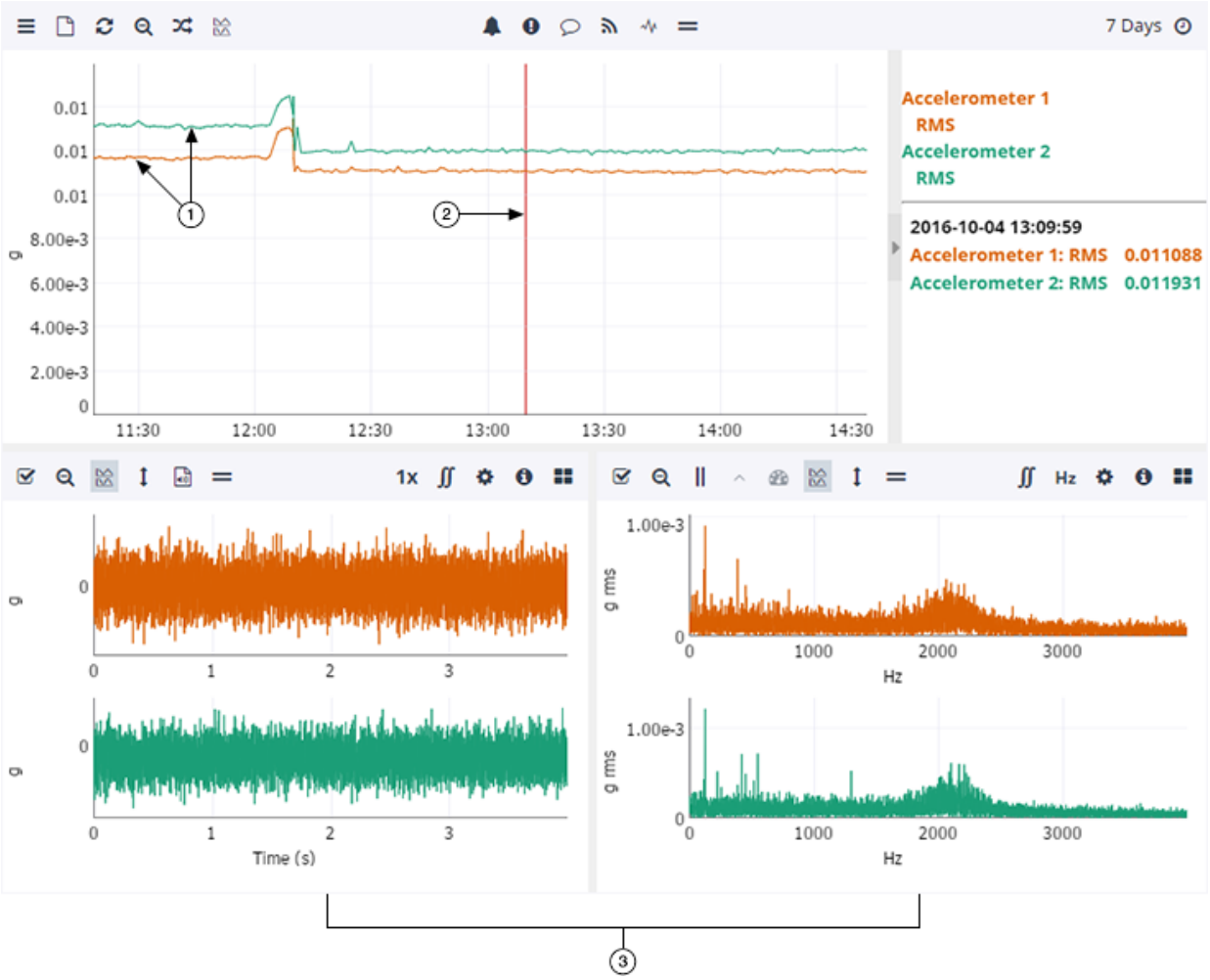

1	Feature trend values—Represent the feature values from acquisitions over time.
2	Cursor within trend curve—Controls which data set appears in sensor data viewers.
3	Sensor data—Represents the data set where the Trend viewer cursor lies.

5.6.1. Adding Harmonic and Sideband Cursors to Viewers

Ensure you are on the Data Viewer page by clicking the **Data Viewer** button.

You can enable harmonic or sideband cursor indicators in spectrum viewers. Harmonic and sideband cursors are particularly useful in analyzing and diagnosing spectrums.

To add harmonic or sideband cursors to a viewer, click the **Cursor** button on the viewer toolbar and select **Harmonic** or **Sideband**, then click the point on the chart where you want to place the cursor.

You can reposition the cursors by double-clicking another point on the chart, or by single-clicking the sideband or harmonic you want to select.

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The pull-down menu for the **Cursor** button ( ) on the viewer toolbar contains the following options.

1. Normal—Displays only the fundamental cursor in the viewer.
2. Harmonic—Displays cursors to the right of the fundamental cursor at fixed intervals that are integer multiples of the x-axis value of the fundamental cursor. For example, when the fundamental cursor is at 100 Hz, the first harmonic cursor will be at 200 Hz, the second at 300 Hz, the third at 400 Hz, and so on.
3. Sideband—Displays cursors at fixed intervals on the left and on the right side of the fundamental cursor.
4. Change the number of harmonic and sideband cursors.
   a. To change the number of cursor lines that display when you enable the harmonic or sideband cursor, click the **Settings** button on one of the viewer toolbars and select **Viewer Settings** .
   b. Specify the numbers you want in the resulting dialog box.
   c. Click **OK**.

5.6.2. Adding, Changing, and Removing Viewers

Customize the workspace by adding, removing, or changing the types of viewers in the workspace.

If you create a layout you want to reuse, you can save that layout and restore it later. When you exit the Data Viewer page or switch modes, the workspace does not preserve your changes to the layout unless you save the layout.

Complete the following steps to add a new viewer to the workspace.

1. Click the **Data Viewer** ( ) button.
2. Click the **Layout** menu in the top right-hand corner of the Data workspace.
3. Click **New Row** to add an empty row to the bottom of the workspace.
4. Click **Add Chart** and choose which row you want to add your viewer to. The Data Viewer page adds an empty area at the row you selected. The Trend viewer is always the left-most viewer in the top row.
5. Change the type and size of a viewer.
   - Viewer Type—Click the **Layout** menu in the toolbar for any viewer except the Trend viewer and select **Chart type > Type**.

     You cannot change the Trend viewer to a different viewer type.

   - Size—Hover over and drag the separating bars around any area, including the asset tree and properties pane.
6. Remove rows and charts.
   - To remove any viewer except the Trend viewer, click the **Layout** menu on the viewer toolbar and select **Remove this chart**.

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- To remove an entire row of viewers, click the **Layout** menu on a viewer toolbar and select **Remove entire row**.

> The Trend viewer is always visible, and you cannot remove it from the workspace.

5.6.3. Stacking Charts in the Same Viewer

Stack multiple charts in the same viewer.

Some viewers can display plots in separate, stacked charts within the same viewer. Complete the following steps to stack multiple charts in the same viewer.

1. Click the **Data Viewer** ( ) button.
2. In the asset tree, <Ctrl-click> or <Shift-click> multiple features to load them in the viewers.
3. Click the **Stacked Charts** ( ) button on the viewer toolbar.
4. (Optional) Click the **Normalize Y-Axis Scales** button on the viewer toolbar to give each separate chart the same y-axis values.

5.6.4. Modifying Default Units and Scaling for Data

1. Click the **Navigation** menu ( ) and select **Options**.
2. In the resulting dialog box, select **Units and Scaling** under the Data Viewer section in the navigation pane.
3. You can do the following.
   - Change the units to integrate and differentiate.
   - Specify the default value for Single Integration Cutoff and Double Integration Cutoff.
   - Change the acceleration, velocity, and displacement scaling for Spectrum, Full Spectrum, and Waterfall viewers.

5.6.5. Viewer Types

The following table lists the types of viewers you can add to the Data Viewer workspace, the sensors they support, and requirements for configuring the assets to which the sensors are mapped.

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Viewer	Use Case	How to Use	Supported Sensors
Auto-Correlated Spectrum	Display the measure of how similar a spectrum signal is to itself with a time lag. Find repeating patterns in the signal.	Move the cursor along a trend curve to update this viewer with the spectrum measurement at different times.	Vibration sensors that acquire waveform data, such as acceleration.
Auto-Correlated Waveform	Display the measure of how similar a waveform signal is to itself with a time lag. Find repeating patterns in the signal.	Move the cursor along a trend curve to update this viewer so it displays the measurement at different times.	Vibration sensors that acquire waveform data, such as acceleration.
Bode[1]	Contains two charts that display the phase measurement and the amplitude response.	The data group to which these sensors are assigned must specify a tachometer as the speed reference. Configure the **Speed Reference** for the asset on the Properties tab of the Asset Configuration page.	Sensors with both 1x Phase and 1x Magnitude or 2x Phase and 2x Magnitude features.
EMSA Spectrum	EMSA Spectrum viewers display the frequency spectrum measured by an HFCT.	Set the cursor on a data set on the Trend Viewer to view the frequency spectrum.	High frequency current transformer (HFCT).
EMSA Waterfall	The EMSA Waterfall viewer simultaneously displays the EMSA spectra of successive measurements from a sensor. Shows how spectral data changes over time.	Set the cursor a data set on the Trend Viewer to view the spectra of successive sensor measurements.	High frequency current transformer (HFCT).
Envelope Spectrum	The Envelope Spectrum viewer displays the power spectrum of the envelope waveform data.	Use this viewer with the Envelope Waveform viewer to detect ringing impulses, such as bearing defects.	Vibration sensors that acquire waveform data, such as acceleration.
Envelope Waveform	The Envelope Waveform viewer displays the amplitude demodulated signal from sensor data.	Use this viewer with the Envelope Spectrum viewer to detect ringing impulses, such as bearing defects.	Vibration sensors that acquire waveform data, such as acceleration.
Full Spectrum	The Full Spectrum viewer displays a spectrum of an orbit. A full spectrum takes two separate sets of sensor data from orthogonal probes, and transforms the two spectrums to create the full spectrum. The positive frequencies indicate forward precession, where the direction of shaft orbit is the same as the direction of shaft	Configure the following settings on the asset's **Properties**tab: ▪ Specify the name of the other sensor for the **Pair Sensor** property of each sensor. ▪ Assign the sensors to a data group with a tachometer as the speed reference.[3]	Pairs of displacement sensors that acquire waveforms from orthogonal probes. [2]

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Viewer	Use Case	How to Use	Supported Sensors
	rotation. The negative frequencies indicate reverse precession, where the direction of shaft orbit is the opposite direction of shaft rotation.		
MCSA Envelope Spectrum	This viewer displays the spectrum of the envelope waveform data and finds smaller signals, such as pole pass, mechanical speed, and fault frequencies.		Motor current sensors that MCSA devices support.
MCSA Spectrum	MCSA Spectrum viewers display a high-resolution spectrum of the motor current magnitude for motor analysis.	The spectrum resolution of the MCSA Spectrum viewer is higher than that of the Spectrum viewer. The spectrum based on the motor current magnitude is in decibels. The decibel reference is the fundamental component magnitude value. The following parameters in the MCSA Spectrum viewer have fixed values: ▪ frequency range: 0 to 310 Hz ▪ frequency resolution: 0.016667 Hz ▪ lines of resolution: 18,600	Motor current sensors that Motor Current Signature Analysis (MCSA) devices support.
MCSA Torque Waveform	This viewer displays the calculated time-domain torque waveform of the motor output for analysis. The duration of the MCSA torque waveform is shorter than the voltage and current waveforms due to internal processing delay.	The accuracy of the calculated torque waveform may be affected if the motor Stator Resistance is configured improperly.	Virtual motor sensors that Motor Current Signature Analysis (MCSA) devices support.
Orbit	The Orbit viewer displays the actual shaft centerline movement inside the bearing housing.	When you turn on integration, the viewer populates the orbit using integrated time-domain data. Configure these settings on the asset's **Properties** tab: ▪ For the **Pair Sensor** property of each sensor, specify the name of the other sensor.	Pairs of displacement sensors that acquire waveforms from orthogonal probes. [2]

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Viewer	Use Case	How to Use	Supported Sensors
		▪ Assign sensors to a data group with a tachometer as the speed reference[3].	
Order Spectrum	The Order Spectrum viewer displays the power spectrum of the order waveform data.	Use this viewer with the Order Waveform viewer to see data when the equipment speed is changing or when comparing data acquired at different machine speeds. Assign the sensors to a data group with a tachometer as the speed reference.	Vibration sensors that acquire waveform data, such as acceleration.
Order Waveform	Displays the waveform data re-sampled to a constant number of samples per revolution.	Use this viewer with the Order Spectrum viewer to see data when the equipment speed is changing or when comparing data acquired at different machine speeds. Assign the sensors to a data group with a tachometer as the speed reference.	Vibration sensors that acquire waveform data, such as acceleration.
Phasor Diagram	Displays the voltage and current phasors relative to phase A voltage.	Phasors with angles from -180 degrees to 0 degrees lag the reference, while phasors with angles from 0 degrees to +180 degrees lead the reference.	Motor current sensors that Motor Current Signature Analysis (MCSA) devices support.
Polar[1]	Display data in polar coordinates and see phase changes in the range of zero to 360 degrees.	The polar plot zero degree point is always located at the angular position of a transducer. Compare data from orthogonally-mounted displacement probe pairs with a polar plot. The data group must specify a tachometer as the speed reference. You can configure the **Speed Reference** property on the asset's **Properties** tab.	Sensors with both 1x Phase and 1x Magnitude or 2x Phase and 2x Magnitude features.
Pole Profile	Display data events from Air Gap sensors.	Configure an Air Gap Group with some Air Gap sensors and collect data. Change one of the viewers to the Pole Profile and drop trends from configured Air Gap sensors.	Air Gap sensors.
Rotor Shape	Display calculations of Air Gap trend data in the shape of a rotating stator.	Drop trends from configured Air Gap sensors.	Air Gap sensors.
Shaft Centerline[1]	Plots the average radial shaft position to show changes in shaft position during run-up or coast-down in relation to the surrounding, fixed bearing. To indicate the distance from the center point of the bearing, the viewer contains a dashed line that begins at the zero point of the axis system and ends at a point	Assets must have gap features.	Pairs of sensors connected to orthogonal probes.[2, 3]

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Viewer	Use Case	How to Use	Supported Sensors
	of the curve where the viewer cursor lies.		
Spectrum	Displays the frequency domain representation of an acquisition measurement.	Move the cursor along a trend curve to update this viewer with the spectrum measurement at different times.	Vibration sensors that acquire waveform data, such as acceleration.
Table	Observe features from multiple sensors simultaneously when you move the cursor or view a stream in the Trend viewer. An empty cell means that InsightCM Server is not configured to calculate that feature for a particular sensor.	Tables show the value of each feature loaded in the Trend viewer at the time where the cursor lies.	All sensor types.
Thermal Imaging	Compiles temperature data collected from a thermal camera into an image based on the color palette you select.	Set the cursor on a data set on the Trend Viewer to view temperature data.	Cameras that Thermal Imaging (IR) devices support.
Trend	Shows the plotted values of features and spectral bands over time.	This viewer is always visible on the Data Viewer page workspace. Display any number of features from any number of sensors. The x-axis represents the system time. The y-axis represents feature values that InsightCM Server calculates from measurements. Static sensors (i.e. digital inputs and temperature sensors) do not produce waveform data and therefore support only the Trend and Table viewers.	All sensor types.
TSA (Time Synchronous Averaging) Spectrum	Displays the power spectrum of the TSA waveform data from a specific acquisition.	Move the cursor along a trend curve to update this viewer with the spectrum measurement at different times.	Vibration sensors that acquire waveform data, such as acceleration.
TSA Waveform	Displays the time-domain representation of a measurement with reduced noise and non-snychronous energy from a specific acquisition.	Move the cursor along to a trend curve to update this viewer to display the measurement at different times.	Vibration sensors that acquire waveform data, such as acceleration.
Waterfall	Displays the spectra of successive measurements from a sensor simultaneously. Shows how spectral data changes over time.	Set the cursor a data set on the Trend Viewer to view the spectra of successive sensor measurements.	Vibration sensors that acquire waveform data, such as acceleration.

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Viewer	Use Case	How to Use	Supported Sensors
Waveform	Displays the time-domain representation of a measurement from a specific acquisition.	Move the cursor along a trend curve to update this viewer to display the measurement at different times.	Any sensors that acquire waveform data, such as acceleration.

[1]Trend viewers that show feature data over time rather than data from a specific acquisition.

[2] The actual angle between orthogonal probes does not need to be exactly 90 degrees. Angles of 80–100 degrees are typically acceptable.

[3]While not required, Cutsforth recommends you configure the bearing-clearance properties for orbit and Shaft Centerline viewers in the **Properties** tab of the Asset Configuration page.

5.6.5.1. Configuring Default Options for Viewers

Click the Navigation menu (⌄) and select **Options**. Modify default options for waveform, spectrum, orbit, waterfall, and table viewers in the resulting dialog box.

5.6.6. Keyboard Shortcuts

Defines keyboard shortcuts that can be used on the Viewer page.

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Keyboard Shortcuts	Description	How to Use Shortcuts
Left and right arrow keys	Moves the cursor in the selected viewer between collected data sets.	1. Double-click a viewer showing data. 2. For the Trend Viewer, click the **Annotate Data Sets** button to view the data sets you can move between. 3. Use the left and right arrow keys to move the cursor between the different data sets.
Up or down arrow keys	Changes which feature data set to display in the selected viewer when two or more features are selected. Does not apply to the Trend viewer.	1. Hold Ctrl and select more than one feature in the asset tree. 2. Click within a viewer showing data. 3. Use the up or down arrow keys to change which feature data set shows in the viewer.
Shift + left and right arrow keys	Changes the cursor you select and enables you to adjust that cursor's distance from the fundamental. Applies only to viewers, like the Spectrum viewer, that have multiple cursors - such as, harmonic and sideband.	1. Double-click within a viewer that has multiple cursors to set a fundamental. 2. Click the Cursor ( ) button and select the last cursor option to set equidistant sideband or periodic cursors. 3. Click to set the sideband or periodic cursors. 4. Hold Shift and use the left and right arrow keys to change which cursor you have selected. 5. Release the Shift key and just use the right and left button to adjust the distance of the selected cursor from the fundamental.
Shift + up or down arrow keys	Changes in which fault frequency is displayed on the viewer. Only applies to viewers that support fault frequencies and when you have configured the displayed asset with multiple fault frequencies.	1. Configure an asset with fault frequencies (page 88). 2. Double-click a data set in the Trend viewer. 3. Click within a viewer showing data. 4. Hold Shift and use the up or down arrow keys to change which fault frequency is on display.

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5.7. Exit Conditions

Configure exit conditions to prevent your device from collecting a large number of data events for an extended period of time.

Leaving a device in a stream-enabled operating state for an extended period of time might result in a large number of data events. To prevent excessive data event creation, you can define exit conditions for a stream-enabled operating state in: Asset Configuration page » equipment asset » Operating States tab.

5.8. Analyzing Data

5.8.1. Annotating Data

Add annotations to the data you have collected.

Availability: Periodic Data mode

In Periodic Data mode, you can annotate a data set by adding comments or attaching files to it. You and other users can see this annotation when the data set is loaded in the Trend viewer.

Complete the following steps to add a comment or attachment to a data set:

1. Click the Data Viewer ( ) button.
2. In the Trend viewer, double-click to place the cursor at the data set of interest.
3. Click the Action menu ( ) on the Trend viewer toolbar and select Add Comment.
4. In the resulting dialog box, click the Add comment or Add attachment button to annotate the data set.

5.8.2. Changing the Time Range of Trends

In Periodic Data mode, the Trend viewer has a time-range property that controls the length of trends you load. Even if more data is available on the InsightCM Server, the Trend viewer displays only data from the configured time range.

In Stream Data mode, the time range is restricted to the duration of the stream you load. If you change the time range of the Trend viewer, the following viewers update to match the new Trend viewer time range:

- Bode
- Polar
- Shaft centerline

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- Waterfall

Complete the following steps to change the time range for which you want to view data.

1. Click the **Data Viewer** ( ) button.
2. Click the **Set time range** ( ) button on the Trend viewer toolbar
3. Select or set a date and time range.

5.8.3. Compensating for Slow-Roll Data

Enable compensation for slow-roll data when viewing your data.

Vector Compensation - When you configure sensors, InsightCM provides 1x Magnitude Reference and 1x Phase Reference properties that specify the magnitude and phase values when the shaft is at slow-roll speed. The Data Viewer page uses these properties to compensate for slow-roll in Bode and Polar viewers. If the configured reference values are incorrect, or you want to temporarily override them with different values, you can compute and apply new slow-roll references within the Data Viewer page. Complete the following steps to change the configured magnitude and phase references.

1. Click the **Data Viewer** ( ) button.
2. Click the **Layout** ( ) button on one of the viewers, navigate to **Chart type > Vibration**, and select **Bode** or **Polar**.
3. Click the **Slow-Roll Override** button on the Bode or Polar viewer toolbar to open the **Set Slow-Roll Override** dialog.
4. Complete one of the following steps.
   a. Modify the values in the Magnitude and Phase columns.
   b. Click **Cursor Values** to set the override values to the magnitude and phase feature values. In the Bode and Polar viewers, you must place the cursor at a point on the chart in order to enable **Cursor Values**.

   Waveform Compensation - To distinguish between data that indicates a physical imperfection in equipment, such as a scratch on a shaft, and pure vibration data, the web application applies waveform compensation for slow-roll data. When the Order Waveform or Order Spectrum viewer displays a data set, the web application subtracts slow-roll data from that data set.

   Complete the following steps to enable slow-roll compensation.
5. On the Order Waveform or Spectrum Order viewer, click **Settings > Viewer Settings > Perform slow-roll compensation**.

5.8.4. Compensating for DC Gap Offset

Change the configured gap reference for the Orbit or Shaft Centerline viewers.

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1. Click the **Data Viewer** ( ) button to navigate to the Data Viewer page.
2. Select the **Layout** button for one of the bottom row charts and navigate to **Chart Type » Vibration » Orbit** or **Shaft Centerline**.

   This will change the chart type and the corresponding toolbar buttons.
3. Expand a Displacement sensor and select a feature that has calculated data to activate the chart's toolbar options.
4. Click the **Gap Override** button on the chart toolbar.
5. In the resulting **Set Gap Override** dialog box, complete one of the following steps.
   - Modify the values in the Override Value column.
   - Set the override value to the corresponding gap feature value at that timestamp by clicking the **Gap Values** button. In the Shaft Centerline viewer, you must place the cursor at **Gap Values** .
   - Restore the configured gap reference value by click **Configured Values** in the Set Gap Override.

5.8.5. Analyzing Unusual Data Events

Configure your data dissection options and dissect a data event:

1. Select the **Navigation menu** ( ) and select **Options**.
2. In the **Options** dialog box, navigate to **Data Viewer » Data Event Dissection**.
3. Use the Data Event Dissection options to specify how to divide data events. You can divide data events into static block-lengths, a number of equal-length blocks, or into blocks of progressively shorter lengths. The **Progressive** data dissection option splits the last five seconds of the waveform into 200 ms sections, the previous five seconds into 0.5 second sections, and the rest of the waveform into one second sections.
4. In the Trend viewer on the Data Viewer page, double-click the data event you want to dissect.
5. In the **Action menu** ( ) on the Trend viewer toolbar, select **Dissect Data Event**.

   When you dissect a data event in the Trend viewer, you can use any of the other available viewers to investigate the values of any of the features in your asset tree at the time of the data event.

5.8.6. Integrating or Differentiating Data

Apply single or double integration or differentiation to acceleration, displacement, and velocity data from your viewer.

Only the Orbit, Spectrum, Waterfall, and Waveform viewers support integration and differentiation.

1. Click the **Integration** ( ) button on the viewer toolbar.
2. Select an option on the dialog box and set the cutoff for the integrations you want to perform.
3. Click **OK** and the viewer will update to show the integrated or differentiated measurements.

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5.8.7. Correlations of Data to Speed and Events

5.8.7.1. Correlating Data to Speed

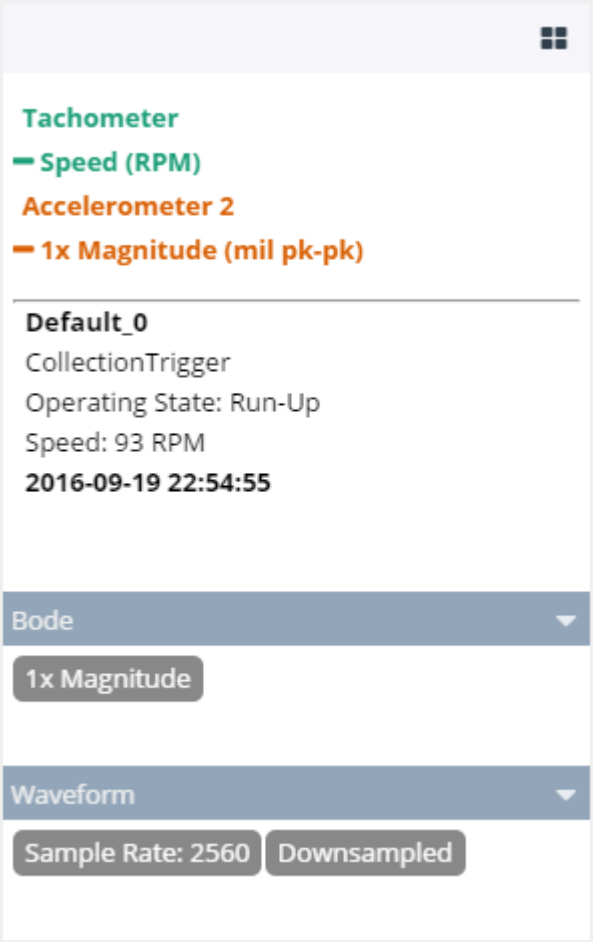
The Data Viewer page always displays the speed value from a sensor's speed reference in the metadata pane. The speed reference can be a tachometer, a fixed, user-defined speed, or a data source - such as, OPC UA or Modbus.

> To view the metadata pane, click the **Layout** menu on the Data Viewer page toolbar and select **Show Metadata** .

5.8.7.2. Correlating Data to Events

You can annotate data to document the cause of a fault, or you can add comments to record information about a particular data set. InsightCM Server stores annotations with the data they apply to, and you can view annotations for a trend plot by clicking the **Annotate Comments** button on the Trend viewer toolbar.

The following metadata pane shows the information displayed when you analyze displacement data from a run-up stream. Notice the value of the speed reference at the time of acquisition.



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5.9. Preserving Data

Set exceptions to data-aging rules to retain data anomalies you want to view in the future.

InsightCM automatically deletes historical data when specified conditions are met if administrators set data-aging strategies (page 153). Aging conserves space on the server, but you may want to ensure data from a specific acquisition remains available for viewing. Preserve data by marking the file for retention.

Complete the following steps to have the server retain data associated with a specific acquisition:

1. Click the **Data Viewer** ( ) button to navigate to the Data Viewer page.
2. Expand the equipment and sensor for which you want to set an exception and select a feature.
3. Move the cursor to the point of interest in the Trend viewer and double-click it.
4. Complete the following step according to the current workspace mode:

   a. Periodic Data mode: Click the Trend viewer **Action menu > Data Events** ( ) and select **Retain Data Event** . The Data Viewer page identifies the sensor and acquisition to be retained and also prompts you to enter an optional comment that the server will store with the data.

   b. Stream Data mode: Click the Trend viewer **Action menu > Data Events** ( ) and select **Retain Stream**. The feature and sensor data remains accessible whenever the Trend viewer time-axis contains the time at which the acquisition occurred.

   The server will retain all data associated with the sensor acquisition, not just the trend value or curve that was active when you clicked the **Retain Data Event** button. Retaining data means you have access to feature values, the time waveform, and other measurements, such as the FFT curve.
5. To export a TDMS file for a data event, click **Action menu > Data Events**.
6. Select **Export Data Event** and open the downloaded file.

5.10. Deleting Data

Delete unneeded data retained by the server in order to conserve space and memory.

Before you begin, ensure that your role has the correct permissions to delete data.

> Data that you delete for an entire asset is not limited to one or more sensor features in the Trend viewer and includes trend and data collections.

1. Click the **Data Viewer** ( ) button to navigate to the Data Viewer page.
2. Click and drag over the time range in the Trend viewer.
3. Complete the following step according to the current workspace mode:

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a. Periodic Data mode: Click the **Action menu** ( ) on the Trend viewer toolbar and select **Delete Data Events**.

b. Stream Data mode: Click the **Action menu** ( ) on the Trend viewer toolbar and select **Delete Stream**. If you delete a data event that is part of a stream, you will delete the entire stream.

5.11. User-Initiated Triggers

Users manually initiate data set collections via the following triggers.

Type	Description	Use Case	Where to Initiate
Force Trigger	Collect a data set on demand.	Check the health of equipment.	Click the **Data Viewer** ( ) button, **Action menu** ( ), and select **Force Trigger**.
Burst Mode	Temporarily collect high resolution data on demand.	Check the health of equipment using high resolution data.	Click the **Data Viewer** ( ) button, **Action menu** ( ), and select **Collect Burst Data Sets** option.

5.11.1. What Happens When Triggers Occur During Data Collection?

When triggers occur at the same time a device is acquiring data, the device buffers the first data set collection trigger and begins another data set collection when the initial one ends. If two or more triggers occur during the data set collection, the device ignores the second and subsequent triggers. Consider the data set collection settings in the following example.

Setting	Value
File Length	10 Seconds
Delta EU Trigger Level	3 Engineering Units
Alarm Rule	Above 75 Degrees

The following table describes how this behavior affects the contents of the data events the device creates and the way the data displays in on the Data Viewer page. Observe how the contents of the data events do not always match the value of the collection condition field that displays below the equipment name in the metadata pane when you select data on the Data Viewer page.

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Data Event	Trigger	Contents	Collection Condition Displayed on the Data Viewer Page
1	Force trigger	Data from time 0-10 seconds, including the following events: ▪ Force trigger ▪ Delta EU change ▪ Alarm set ▪ Alarm clear	User Event
2	Delta EU change	Data from time 10-20 seconds	Delta EU Trigger

5.11.2. Force Triggering an Acquisition for One Data Group

Use Force Trigger to acquire data from a single data group.

Complete the following steps to acquire data from channels associated with one equipment asset.

1. Click the **Data Viewer** ( ) button.
2. Expand the equipment asset for which you want to force trigger an acquisition, expand one of the sensors, and select one of the features to activate the Trend viewer chart.
3. In the Trend viewer chart, click the **Action menu** and select **Force Trigger** to perform an acquisition for that data group.
4. Wait several seconds for the acquisition to be complete and then confirm that data has been acquired by clicking the **Refresh** button and reviewing the Trend viewer chart.

   It may take up to a few minutes for wireless monitoring gateways, wireless vibration measurement devices, and wireless vibration sensors to complete the acquisition.

5. Repeat the force acquisition several times to acquire multiple data sets.

   Before the data is available, devices must finish performing the acquisition and the InsightCM server must receive and store the data. The duration of a force-triggered acquisition is based on the file length of the **Default Operating States** for the equipment.

5.11.3. Manually Requesting Temporary High-Resolution Data Acquisition

High-resolution data is useful for troubleshooting equipment. To collect high-resolution data, you can use burst mode.

Burst mode has to be configured.

Complete the following steps to force trigger and view a periodic acquisition.

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1. Click the **Configuration pull-down** ( ) and select **Devices**.
2. Double-click the device from which you want to collect high-resolution data.
3. On the **Device Properties** tab, select the **Enable Burst Mode** checkbox and configure the **Burst Collection Settings**. If you make changes in this step, update the device configuration on the **Devices** tab of the Device Configuration page.
4. Click the **Action menu** ( ) on the Trend viewer toolbar and select **Collect Burst Data Sets** .
5. Ensure the workspace is configured to load data from the appropriate time range.
6. If the Trend viewer already contains curves for the features or sensors of interest, click **Refresh trend data** ( ) in the viewer toolbar. You may need to wait a few minutes to see high-resolution data in viewers, because devices must switch to burst mode, perform the high-resolution data acquisition, and send the data to the InsightCM server.

5.12. Baselines and Data Event References

5.12.1. Creating a Trend Baseline

Trend baselines determine the values that InsightCM uses to create trend alarms.

Complete the following steps to create a trend baseline for an asset.

1. Click the Navigation menu ( ) and select **System > Trend Baselines**. .
2. In the Trend Baselines dialog box, select the asset for which you want to create a baseline.
3. Click **Add**.
4. In the Create Trend Baselines dialog box, select an operating state.

   > InsightCM creates a baseline from the asset data acquired in the operating state you select.

5. Click **OK**.

5.12.2. Displaying Individual Trend Values

When you view data, the cursor appears as a vertical red line that intersects the plot at a point where a data set was acquired, as shown in the image below.

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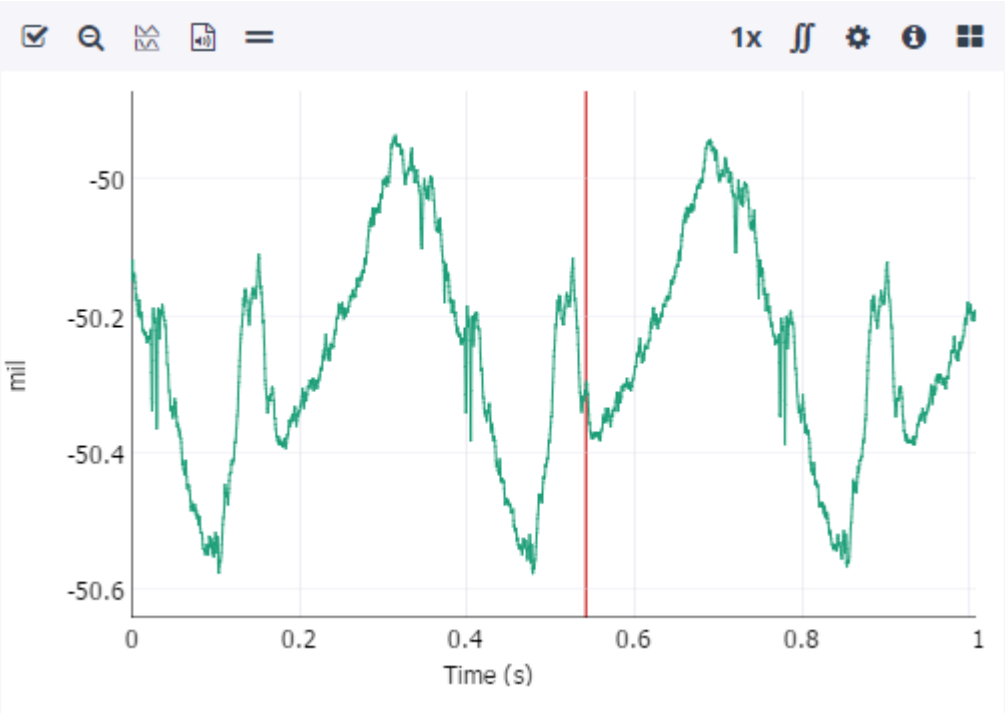

Complete the following steps to move the cursor to a data set of interest on a trend plot.

1. Click the **Data Viewer** ( ) button.
2. Click the **Annotate Data Sets** button on the Trend viewer toolbar to show all points where data was acquired.
3. Double-click the data set you want to inspect. You can also press the <Left-arrow> or <Right-arrow> keys to move the cursor from data set to data set. Although the Trend viewer calculates feature trend points even when no data is acquired, you can only place the cursor at points where there are data sets.

   When you place the cursor on a data set in the Trend viewer, the other viewers automatically update with sensor data from the selected data set.

5.12.3. Viewing Historical Data

Analyze historical periodic data by loading a feature in the Trend viewer and then loading the data set in a waveform, spectrum, or other sensor data viewer.

The Trend viewer serves as a master viewer for the workspace because you load and browse feature trends to see sensor data.

Complete the following steps to load a trend and view the sensor data that comprise the trend:

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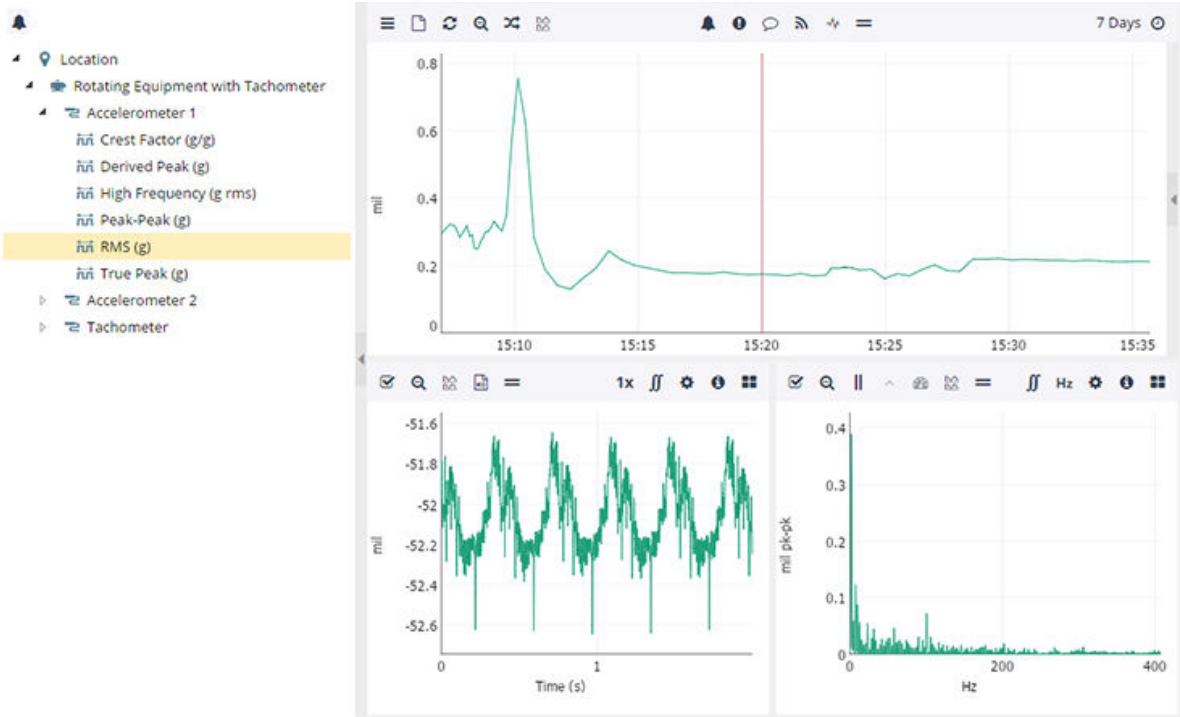
1. Click the **Data Viewer** ( ) button.
2. Select an asset feature to load its data in the Trend viewer. To load data from multiple features in the Trend viewer, <Ctrl-click> to select multiple features or <Shift-click> to select a range of features.
3. Click the **Annotate Data Sets** button on the Trend viewer toolbar to flag trend points that have data sets associated with them.
4. Double-click a point on the trend plot that has a data set. The sensor data viewers update corresponding to the data set for that trend value. If a viewer remains empty, it might not support the sensor whose features you loaded. Refer to the Unsupported Sensors for Sensor Data Viewers section below for more information.

   The following workspace shows the result of selecting a feature from the asset tree. Notice the trend plot includes a point for each acquisition over a period of several days. The Waveform and Spectrum viewers display the sensor data acquired at the position of the cursor within the Trend viewer.



Unsupported Sensors for Sensor Data Viewers

Some sensor data viewers display data only when the Trend viewer contains features from certain sensors. Consider the following examples:

- Waveform and Spectrum viewers support sensors that acquire waveforms rather than single-point measurements such as temperature.
- The Orbit viewer supports only pairs of displacement sensors connected to orthogonal probes that have the same tachometer reference.

In this situation, sensor data viewers remain empty until you load features from supported sensors in the Trend viewer. Refer to Available Viewers and Options for Configuring Them (page 109) for sensor support considerations for each viewer.

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Conditions Where Data is Unavailable

Although you have access to all data stored on the InsightCM Server, the following factors can affect your ability to load the data:

- In Periodic Data mode, the Trend viewer has a time-range property that controls the length of trends you load. Even if more data is available on the InsightCM Server, the Trend viewer displays only data from the configured time range.
- If administrators set data-aging rules, the server automatically deletes historical data when a set amount of time passes. Aging is useful for conserving space on the server. However, to prevent InsightCM from deleting certain trend values and sensor data due to its age, you can mark the data to be retained.
- In Stream Data mode, you can only load trends from equipment that is part of a stream. Also, the time range in viewers is restricted to the duration of the stream you load, so you cannot see additional data even from equipment that is part of the stream.

5.12.4. Downsampling

Because of screen resolution constraints, the viewer may not be able to display every point in a data set. As a result, some viewers downsample data by default so that viewers can load data faster and conserve memory. This means that the viewer displays only the data points necessary to generate an accurate plot.

When you zoom within a viewer with downsampling enabled, InsightCM queries the server for new data to display. Therefore, the viewer resolution remains the same even though the zoomed view displays fewer points than the original view.

To disable downsampling, complete the following:

1. Click the **Data Viewer** ( ) button.
2. In the viewer toolbar, click the Action menu ( ) button.
3. Select **Settings**.
4. Deselect Downsample if available.

> Disabling downsampling may negatively impact the performance of the web application.

5.12.5. Comparing Measurements from Different Sources or Times

Compare measurements from multiple points in time or from multiple pieces of equipment by creating data event references that you can show in a chart later.

Complete the following steps to create a data event reference:

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1. Click the **Data Viewer** ( ) button.
2. Select an asset.
3. Select a trend point to create a data event reference for the Trend viewer.
4. Click the **Action menu** ( ) and select **Data Event » Create Data Event Reference**.
5. In the **Choose Reference Type** dialog box, choosing creates one of the types of references given below. These references can be used to mark specific data events from an asset and show that data alongside other data from the same asset.
   a. **Baseline**—The default data reference.
   b. **Slow-Roll**—The reference InsightCM uses to calculate slow-roll compensation if you enable slow-roll compensation on the Order Waveform or Spectrum viewer.
   c. **Temporary**—A data reference that disappears after 24 hours.
   d. **Other**—A reference you create for any other reason.
6. Click **OK**.
7. On the Data Viewer page, click **Select a Data Event Reference** and select the data event reference you created.
8. In any viewer on the Data Viewer page, click **Show Reference** to display the reference you selected.

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6. Server Configuration and Maintenance

The InsightCM™ Server requires configuration and maintenance to ensure its functionality, accessibility, and performance.

- Configuring InsightCM 3.8 (page 128)–Manage the settings of your InsightCM server that enable web client accessibility, security, and expandability.
- Maintaining InsightCM (page 151)–Optimize your system by managing packages and configuring an aging strategy for data.

6.1. Configuring InsightCM 3.8

Manage the settings of your InsightCM server that enable web client accessibility, security, and expandability.

Before you begin, upgrade to InsightCM 3.8 (page 13) on your server machine.

Complete the following tasks to ensure that your system is accessible, secure, and complete.

1. Open required ports (page 128)–Open required network communication ports to access the web application and to initiate data collection.
2. Enable and require SSL connections (page 132)–Configure your settings to require a secure connection to access the web application.
3. Integrate InsightCM with Windows Active Directory (page 132)–Integrate InsightCM with your Windows Active Directory to require users to log in with Windows account credentials.
4. Create roles and assign permissions (page 134)–Manage roles with differing levels of permission for editing or accessing your InsightCM system.
5. Learn about and configure historian software (page 139)–Learn how InsightCM Server can connect to data historians with the purchase, activation, and enablement of the Enterprise Gateway option.
6. Configure your server fleet (page 150)–Configure your server fleet by modifying the .json file that installed to your server with InsightCM.
7. Define a transceiver (page 151)–Configure your server fleet by modifying the .json file that installed to your server with InsightCM.

6.1.1. Opening Required Ports for Communication

Open required network communication ports to access the web application and to initiate data collection.

Before you begin, install InsightCM on your machine.

Open required ports to access the web application. Without opening the necessary ports, you cannot configure your assets and devices or begin data collection.

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The installer attempts to open these ports for you.

Complete the following steps to open the ports according to your monitoring needs.

1. Review the following table of ports and the details provided for each to determine which ports you need to unlock.

Port	Type	Description	Details
80	TCP (outbound)	Application Image Deployment	Required
82*	TCP (inbound)	HTTP Web Application	Not required if enabling connection to the web application via SSL.
482*	TCP (inbound)	HTTPS Web Application	Only required if enabling connection to the web application via SSL.
3580	TCP (outbound)	Application Image Deployment	Required
5353	UDP (inbound)	InsightCM Device Communication	Used to find devices on the server's subnet. Only affects the functionality of the "Browse" button when adding devices.
5672	TCP (inbound)	InsightCM Internal Service Communication	Only necessary if using the SDK to communicate with the server from another device.
6343**	TCP (inbound)	InsightCM Device Web Service	Retrieves device information relating to hardware, system health, and connection. Also, sends commands, such as reboot, to the device.
8002	TCP (outbound)	InsightCM Device Communication	Sends measurement and system data from a device to the server.
49580 **	TCP (outbound)	InsightCM OPC Historian Communication	Needs to be opened in the firewall in order for the OPC server to communicate out.
*Configurable through IIS **Configurable through InsightCM			

2. Open the necessary ports.
   - Contact your IT department about opening the necessary ports.
   - Using Windows Firewall Inbound and Outbound rules, allow the following program to communicate:

     lkads.exe, installed at C:\Windows\SysWOW64

Now that you have opened the necessary ports to access the web application, secure your web application by enabling and requiring SSL connections (page 132).

6.1.2. Generating an API Key

Create an API key to enable access to InsightCM data services.

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1. Click the **Navigation** menu (⌄) and select **Options**.
2. Scroll down to Security and click **Web API Keys**.
3. Click **New** to generate a new API key.

   The key you generate is not editable.

4. Copy the API key and save it in a text editor for reference later.

   The key cannot be viewed again once you close the Copy Api Key dialog. Save the key in a text editor for reference later as needed.

5. Delete a Web API Key

Use the API key (page 130) you generated to enable secure access to InsightCM data services from your API.

6.1.3. Accessing InsightCM Data Services Using HTTP API

Access your InsightCM data services in your preferred programming language using the HTTP API.

Before you begin, generate an API key (page 129).

Cutsforth recommends enabling Secure Sockets Layer (page 132) (SSL) or Transport Layer Security (TLS) before proceeding to ensure that the key is encrypted as it is passed over the network.

1. Use the following web service API to connect to InsightCM programmatically and acquire data. All endpoints return a JSON string.

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Path	Method	Description
/IcmApi.svc/assets	GET	Get all the equipment asset nodes and their parents.
/IcmApi.svc/asset-subtree/{assetId}	GET	Get all the descendants of an asset node.
/IcmApi.svc/assets/version	GET	Get the asset collection version.
/IcmApi.svc/data-events/{assetId}? startTs={startTs}&endTs={endTs}&skip=0&take=100	GET	Get data events for an asset.
/IcmApi.svc/trend-points/{trendId}? startTs={startTs}&endTs={endTs}&skip=0&take=100	GET	Get trend points.
/IcmApi.svc/data-event/{dataEventId}	GET	Get data sets.
/IcmApi.svc/archived-data-event/{assetNodeId}?ts={ts}	GET	Get archived data sets.
/IcmApi.svc/active-trend-alarms?skip=0&take=100	GET	Get active alarms.

2. Provide the API key as an HTTP Authorization header in your code. Refer to the examples below for how this can be done in C# and Python.
3. Confirm that you can successfully call InsightCM data services by passing the URL of your InsightCM Server and the API key in the Command Line Interface (CLI) or in the interface for your application.

Providing the API Key in C#

```
var client = new HttpClient();
client.BaseAddress = new Uri(address);
client.DefaultRequestHeaders.Authorization =
new AuthenticationHeaderValue("Api-Key", key);

var response = await client.GetAsync("IcmApi.svc/assets");
response.EnsureSuccessStatusCode();
```

Providing the API Key in Python

```
connection = http.client.HTTPConnection(address)
headers = {"Authorization": "Api-Key {0}".format(key)}
startTs = int((datetime.now() - timedelta(days=1)).timestamp())
connection.request("GET", "/IcmApi.svc/dataEvents/
{0}?startTs={1}".format(asset["Id"], startTs), headers = headers)
response = connection.getresponse()
if response.status != 200:
    raise Exception("Request failed with status {0}".format(response.status))
```

Example 1. C# and Python Examples

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6.1.4. Enabling SSL Connections

Enable Secure Sockets Layer (SSL) connections for access to the web application.

Before you begin, create or provide an SSL certificate.

By default, users do not need to access the web application via an SSL connection. However, as of version 3.8.5 and newer, an SSL certificate will need to be added to the web server configuration for the HTPPS site to function.

Once an SSL certificate has been created or provided, complete the following steps to enable SSL connections to the web application.

1. Open the Internet Information Services (IIS) Manager application from the Windows start menu.
2. In the Connections tree, expand the asset representing the server.
3. Expand **Sites** and select **InsightCM**.
4. In the Actions pane, click **Bindings**.
5. In the **Site Bindings** dialog box, select the https item and click the **Edit** button.
6. Select an SSL certificate you created.
7. Click **OK** in the **Edit Site Binding** dialog box and then click **Close** to return to IIS Manager.

Users can now access the web application via the following URLs: **`//serverDNSHostname`** and **`https://serverIpAddress`**. However, users are still able to access the web application through non-SSL (HTTP) connections.

Now that you have enabled SSL connections, require SSL connections (see Requiring SSL Connections (page 133)).

6.1.5. Integrating InsightCM with Windows Active Directory

Integrate InsightCM with your Windows Active Directory to require users to log in with Windows account credentials.

Complete the following steps to enable LDAP on your browser.

1. In File Explorer, navigate to the following location:

   `C:\ProgramData\Cutsforth\InsightCM\Auth`
2. Open the `LoginAuth.json` file in a text file editor.
3. Modify each line category according to a Windows account in your organization.

> Do not set `DisableBuiltinAccounts` to `true` until after you assign your Windows credentials to an InsightCM role. You will be unable to log in because your credentials lack the necessary permissions.

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> InsightCM uses the DirectoryEntry class to facilitate the LDAP connection. In the LoginAuth.json file, `LdapServiceAccountUserName` and `LdapServiceAccountPassword` are the username and password by the DirectoryEntry class. If you define an LdapDomainName, InsightCM adds it followed by a backslash to the beginning of the username. The LdapConnectionString is used as the path in the DirectoryEntry class. See the example below.

4. Save the changes you made to the file.
5. Log into the web application with the Windows account used to modify the `LoginAuth.json` file.

```
{
  "DisableBuiltinAccounts": false,
  "LdapConnectionString": "LDAP://icm.com/OU=Test,DC=ICM,DC=COM",
  "LdapDomainName": "icm.com",
  "LdapUsernameFilterToken": "sAMAccountName",
  "SessionTimeoutMinutes": 7200,
  "LdapServiceAccountUserName": "Administrator",
  "LdapServiceAccountPassword": "SecretPassword"
}
```

Now that users are required to log in with their Windows credentials, assign roles and permissions (page 134) to each Windows user. After adding Windows Active Directory users to InsightCM roles, disable the built-in accounts and remove the stored LDAP username and password in the .json file.

> See Setting up Email Notifications (page 66) for password format requirements.

6.1.6. Requiring SSL Connections

Require users to connect to the web application using HTTPS.

Before you begin, enable SSL connections.

After you apply an SSL certificate to the https site binding, users can still browse and open the web application using an HTTP connection. Complete the following steps to require SSL connections.

1. Expand **Sites** and select **InsightCM**.
2. Double-click **SSL Settings**.
3. Check the **Require SSL** checkbox.
4. Click **Apply** in the Actions pane.

   If you browse to **`http://serverName:82`**, the browser displays an error because an SSL connection via a URL such as **`https://serverDNSHostname`** is required.

Now that you have enabled and required SSL connections, further secure your system by integrating InsightCM with the Windows Active Directory (page 132).

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6.1.7. Managing Roles and Permissions

Manage roles with differing levels of permission for editing or accessing your InsightCM system.

Before you begin, integrate your InsightCM system with your Windows Active Directory (page 132).

Assign individual users to roles with specific permissions in the InsightCM web application to ensure each user has the appropriate level of access.

1. Click the **Navigation** menu (⌄) and select **Options**.
2. In the **Options** dialog, click **Roles and Permissions** under the **Security** category.
3. Click the **Role** pull-down menu and select an existing role.

   A list of permissions assigned to that role populates in the Permissions field below the pull-down.
4. Click **Add** next to the Permissions field to assign additional permissions to the role.

   For a description of available permissions, refer to the List of InsightCM Web Application Permissions (page 135).
5. Click **Add** next to the Active Directory Roles field to associate one or more Active Directory Roles with the InsightCM role.
6. Enter each Active Directory account that you want to add to the InsightCM role, or use the **Browse LDAP by user for groups** button to find which Windows accounts are recognized by the web application.
7. Click **OK** to exit the **Active Directory Role** dialog, verify that the correct Active Directory account(s) appear in the Active Directory Roles field, and click **OK**.

Any Active Directory user you associated with this InsightCM role has the corresponding permissions.

If you assign an Active Directory user to multiple InsightCM roles, the user receives the permissions of all associated roles.

After assigning Windows Active Directory users to InsightCM roles, return to the `LoginAuth.json` file and set `DisableBuiltinAccounts` to `true` and remove the stored `LDAPServiceAccountUserName` and `LDAPServiceAccountUserPassword`.

Unless you disable built-in roles, users can log into the web application by entering the name of a role and no password.

6.1.7.1. Relationships Between User Accounts and Permissions

Permissions determine which features in the InsightCM web application a user can access after logging in. Several factors determine which permissions a user receives:

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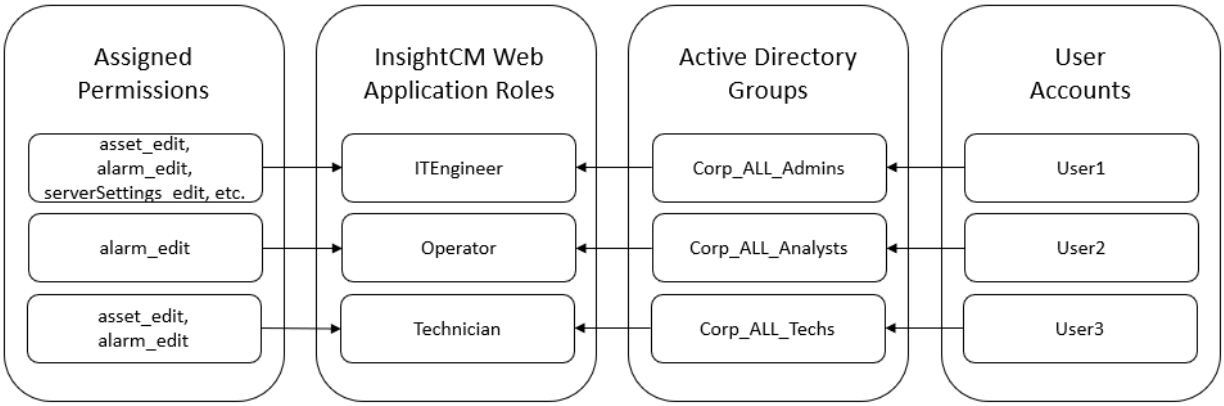
Permissions	The ability to see and/or configure specific pages or tabs in the web application. You assign permissions to roles.
Role	An administrator-defined persona with assigned permissions. Refer to the Creating Roles and Assigning Permissions (page 134) topic to learn how to define new roles and how to configure new or existing roles.
Active Directory group	A group in the Windows Active Directory service running on the server machine that contains user accounts. Groups map to roles. Refer to Integrating InsightCM with Windows Active Directory (page 132) to require users to authenticate with Active Directory. The web application does not require you to authenticate users with Active Directory. An alternative is allowing users to log into the InsightCM web application with the names of built-in roles, which do not require a password.
User account	An account on the Windows domain whose credentials a user enters to log in to the web application. Accounts belong to Active Directory groups and therefore, they receive the permissions from any role to which their Active Directory group is mapped.

The following diagram shows the relationship between all four items. Notice that the user accounts receive permissions via a group. In other words, you cannot apply a set of permissions to just one account because you must apply a set of permissions to a group.



6.1.7.2. List of InsightCM Web Application Permissions

Permissions determine which features in the web application users can access when they log in. Assigning permissions to a user is a two-step process: creating a role with the desired permissions, and then mapping a user to the role.

If you have LDAP configured but have no explicit permissions assigned to your role, you will be unable to log in to InsightCM. Refer to Integrating InsightCM with Windows Active Directory (page 132) for more information.

The following list describes the permissions you can assign to web application roles:

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alarm_edit

Features	Locations Affected
Enables access to the **Acknowledge** button on the **Active Trend Alarms** and **Active Spectral Alarms** tabs of the Alarms page.	▪ Navigation menu (˅) » **Alarms** » **Active Trend** ▪ Navigation menu (˅) » **Alarms** » **Active Spectral**
Displays option to force clear alarms.	▪ Navigation menu (˅) » **Alarms** » **Active Trend** » **Action** » **Force Clear** ▪ Navigation menu (˅) » **Alarms** » **Active Spectral** » **Action** » **Force Clear**
Enables access to the **Add Annotation** button for spectral alarms.	Navigation menu (˅) » **Alarms** » **Active Spectral** and double-click an alarm instance

alarm_rule_edit

Features	Locations Affected
Allows the user to add, edit, and remove trend alarm rules.	▪ Asset Configuration page » **Trend Alarms** tab ▪ Alarms page » **Trend Rules** tab » **Action menu** » **History**

asset_delete

Other permissions required: `asset_edit, dataEvent_delete`

Features	Locations Affected
Enables the **Remove** button above the asset tree and access to the following options in the right-click menu within the asset tree: ▪ Remove with descendants ▪ Remove and promote descendants ▪ Open Device Configuration	Asset Configuration page
Enables access to the **Remove** button on the **Devices** tab.	Device Configuration page

asset_batch_edit

Other permissions required: `asset_edit`

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Features	Locations Affected
Allow users to add, edit, and remove features.	Navigation menu ( ) » **System** » **Features**
Allows users to add and remove units for features.	Navigation menu ( ) » **System** » **Units**
Allows the user to edit asset definitions.	Asset Configuration page » **Action menu** ( ) » **Edit Asset Definitions**
Allows users to import asset spreadsheets.	Asset Configuration page » **Action menu** ( ) » **Import/Export** » **Import Asset Spreadsheet**
Allows users to import device spreadsheets.	Device Configuration page » **Action menu** ( ) » **Import/Export** » **Import Devices Spreadsheet**

asset_edit

Other permissions required: `device_troubleshooting, alarm_edit, alarm_rule_edit`

Features	Locations Affected
Allows user to add to and edit names and locations in the asset tree.	Asset Configuration page
Displays option to disable an asset.	Asset Configuration pages » asset tree
Allows user to apply, edit, import, export, or remove an asset template.	Asset Configuration page » **Action menu** ( ) » **Manage Templates**
Allows the users to add and edit fault frequencies.	Asset Configuration page » right-click menu for a selected asset
Allows the user to import and export asset definition files.	Asset Definition Editor » **Action menu** ( )
Allows the user to create and reset trend baselines.	Data Viewer ( ) » **Trend viewer** » **Action menu** ( )
Allows the user to create data event baselines.	Data Viewer ( ) » **Trend viewer** » **Action menu** ( )
Allows user to edit device configurations.	Device Configuration page
Allows user to change the device name that appears throughout the InsightCM web application.	Device Configuration page » **Action menu** ( )
Enables access to the **Update Application** button.	Device Configuration page » **Software** tab
Displays option to disable the device so the device does not try to contact the server or transfer data events.	Device-related pages » **Action menu** ( )
Displays option to upload, download, and delete devices applications and firmware.	Navigation menu ( ) » **Utilities** » **Package Management**
Allows users to edit the **Auto-Configuration** section of the **Options** dialog box.	Navigation menu ( ) » **Options** » **Auto-Configuration**

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dataEvent_delete

Features	Locations Affected
Allows users to set aging options for data events and streams in the **Options** dialog box.	Navigation menu (˅) » **Options** » **Periodic Aging Strategy** OR **Streaming Aging Strategy**
Allows users to delete data events and streams from InsightCM Server.	Data Viewer ( ) » **Action menu** ( ) » **Data Events**

device_troubleshooting

Features	Locations Affected
Displays the option to reboot a device.	Device Configuration page » **Action menu** ( )
Displays option to reset the connection information for the device.	Device Configuration page » **Action menu** ( ) page

historian_edit

Features	Locations Affected
Allows user to perform tasks on the Historian page, including the following: ▪ Add, edit, remove, import, and export PI point mappings ▪ Add and apply point name patterns ▪ Edit custom feature names	Navigation menu (˅) » **System** » **Historian** page

icm_show

Features	Locations Affected
Allows user to view only data and configurations. This permission is granted with all other permissions.	The entire web client

notification_report

Features	Locations Affected
Allows users to add, edit, and remove only email address groups.	Navigation menu (˅) » **Options** » **Notifications** » **Address Groups**
Allows users to configure only daily notification reports.	Navigation menu (˅) » **Options** » **Notifications** » **Daily Reports**

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serverSettings_edit

Features	Locations Affected
Allows user to edit all of the **Server Settings** section of the **Options** dialog box.	Navigation menu (˅) » **Options** » **Server Settings**
Allows user to edit the **Security** section of the **Options** dialog box.	Navigation menu (˅) » **Options** » **Security**
Allows user to edit spectral alarm rules.	Navigation menu (˅) » **Alarms** » **Spectral Rules**

6.1.8. Historian Software

Learn how InsightCM Server can connect to data historians with the purchase, activation, and enablement of the Enterprise Gateway option. Connecting InsightCM to your historian software makes it possible for InsightCM to write new data to existing historian points and to pull data from historian points for feature calculation or visualization.

- AVEVA eDNA Enterprise Data Management (page 139)—Map data sources in the InsightCM Server to historian points on AVEVA eDNA software.
- OSIsoft PI System software (page 140)—Map data sources in the InsightCM Server to historian points on OSIsoft PI System software. When a device calculates a trend point value, InsightCM writes it to the corresponding historian point.
- Built-in OPC UA server and third-party data historian clients (page 147)—The InsightCM Server includes a built-in server that supports the OPC Unified Architecture (UA) specification. When a trend point value is calculated, InsightCM writes it to a unique tag on the server. Software clients supporting the OPC UA specification can subscribe to the server.

6.1.8.1. Interfacing with eDNA Historians

Connect InsightCM to AVEVA eDNA historian software.

1. Download and install the eDNA User Client Services or eDNA Admin Client Services from AVEVA.

   > Specify the eDNA server's IP or computer name when configuring the DNASYS.INI file during installation.

2. Request the following 64-bit DLLs from AVEVA:
   - `EZDnaServApi64.dll`
   - `EzDNAServApiNet64.dll`
3. On the InsightCM server, save the 64-bit DLLs in the same location as the DLLs that are included with Client Services.

   > The default location for DLLs included with the installation of Client Services is `C:\Program Files (x86)\eDNA`.

4. Save a copy of the following DLLs to the same folder in which InsightCM is saved:

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- `EZDnaApiNet64.dll`(A different DLL than mentioned above)
- `EzDNAServApiNet64.dll`

> The default InsightCM install location is `C:\Program Files\Cutsforth\InsightCM`.

5. Open File Explorer and navigate to where the eDNA configuration file was saved: `C:\ProgramData\Cutsforth\InsightCM\Auth\eDNAConfig.json`
6. Open the `eDNAConfig.json` file in a text editor and edit each field to match your eDNA server.

eDNAConfig - Notepad

File Edit Format View Help

```
{
  "PrimaryUnivServiceIp": "127.0.0.1",
  "PrimaryUnivServicePort": 8000,
  "SecondaryUnivServiceIp": "127.0.0.1",
  "SecondaryUnivServicePort": 8000,
  "SiteName": "EDNA",
  "UnivServiceName": "UNIV",
  "CachePath": "C:\\ProgramData\\Cutsforth\\InsightCM",
  "CacheSizeKb": 2000
}
```

> The eDNA API caches data updates if the API loses connection to the eDNA server. Configure the location of the cache file and the maximum size of the cache by editing the `CachePath` and `CacheSizeKb` properties respectively.

7. Restart the InsightCM service to integrate a data historian.
   a. Start Windows Services.
   b. Find and select **InsightCM <version>**.
   c. Click **Restart**.
8. In InsightCM, click **Dashboard** ( ) and select the Historian tab to check the connection status.

6.1.8.2. Interfacing with OSIsoft PI System Software

Enable InsightCM to interface with OSIsoft PI System software.

Before you begin, install the OSIsoft PI Asset Framework (AF) Client and activate a run-time license on the same machine that runs InsightCM Server.

1. Launch Windows Services.
2. Select the **InsightCM <version>** entry in the list of services.
3. Click **Restart** .

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> Restart the InsightCM software to integrate a data historian.

4. Launch InsightCM.
5. Click the Navigation menu (˅) and select **System > Historian**.
6. Assign the following permission to web application users working with point mappings.
   - `historian_edit` — Allows you to add, edit, remove, import, and export mappings to historian points, add and apply point name patterns, and customize the feature names that appear in point names.

Components for Writing Values to Historian Points

Map sources of data in InsightCM to historian points to write values to the historian software. Whenever the source produces a value, InsightCM writes the value to the corresponding point in the historian software.

Components for Writing to Historian Points

InsightCM uses the following components to write data to your historian software.

Component	Description
Historian Point	A time-stamped value stored in the historian software. InsightCM uses the point mappings you create in the web application to write values to your historian software.
Feature	A measurement derived from collected data. For example, the most recent RMS value from acceleration data that a particular sensor acquires is a feature. Create a point mapping for a feature and InsightCM will write values from that feature to a historian point on the historian software.
Point mapping	The mapping of a feature in InsightCM to the name of a historian point in the historian software.

Troubleshooting Missing Historian Points

If the status of a sensor is open, InsightCM does not write the values of features or spectral bands to the historian software, which may result in missing historian points. To check historian points, refer to Reviewing the Latest Value (page 144) or Querying the Historian Software (page 144).

Adding Point Mappings for Equipment Assets

Add point mappings for one or more assets to enable InsightCM to write data to the historian software.

1. Click the Navigation menu (˅) and select **System > Historian**.
2. In the Point Mappings tab, click **Add**.

> You can only add point mappings for sensor assets that are children of equipment assets.

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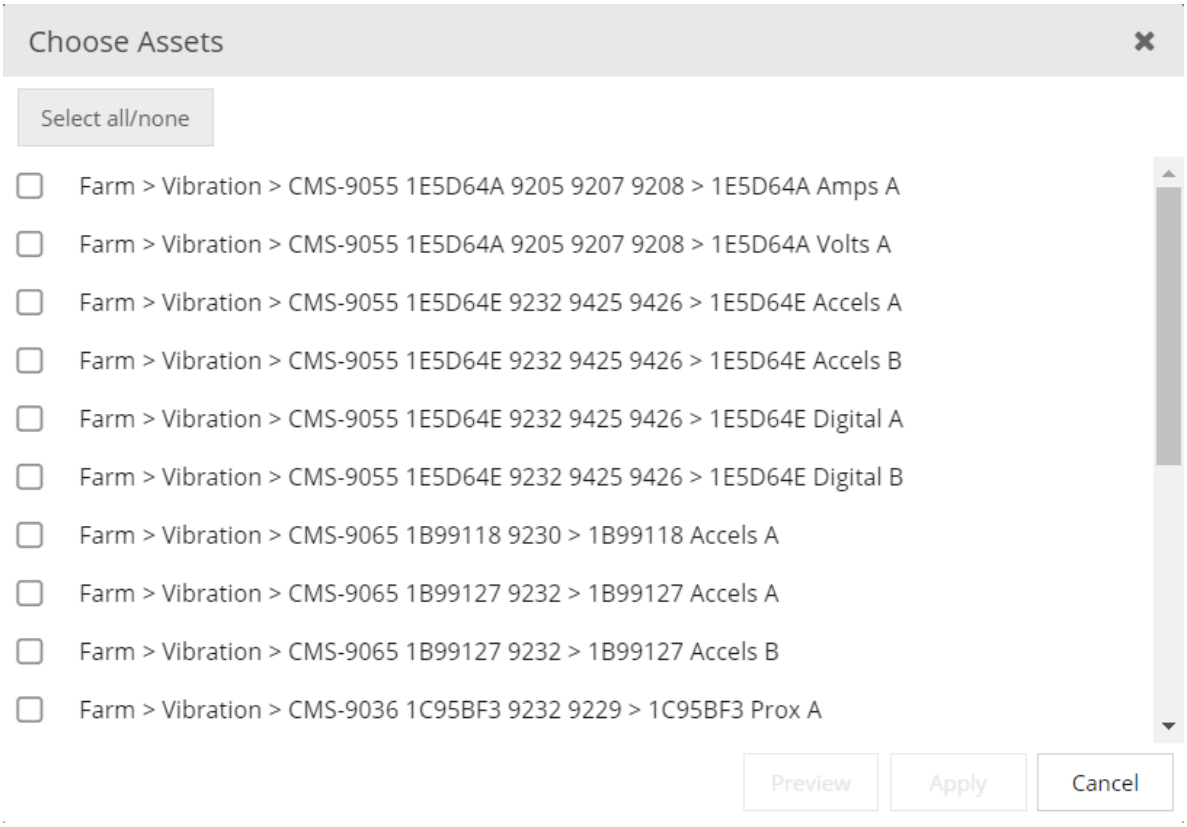
3. In the **Choose Assets** dialog, select one or more assets.



4. Click **Preview** to review the list of features associated with the equipment asset that you are creating point mappings for.

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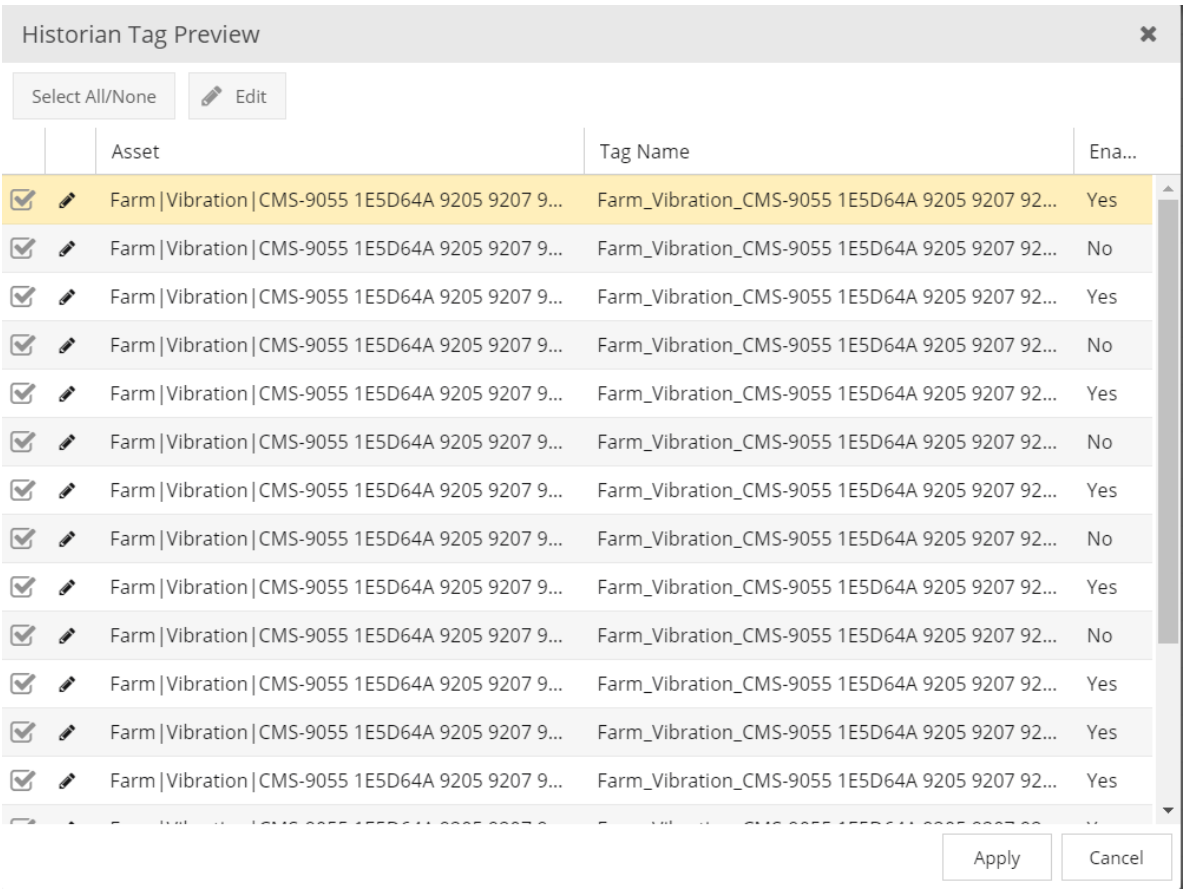

5. Ensure that features you want to create point mappings for are selected and that both the asset and the point name are correct.

> If you want to edit the name of an asset or a point name, select the point mapping and click **Edit**.

6. Click **Apply** to create the point mappings.

Creating Point Names Automatically

Create a point name pattern to automatically generate point mappings for assets.

1. Click the Navigation menu (˅) and select **System > Historian**.
2. On the Point Name Patterns tab, select an asset type and click **Edit**.
3. Enter the static text and tokens you want InsightCM to replace with dynamic information about the tag source.

   The following list contains tokens you can include in point name patterns. Surround each token with curly braces, as shown. Asset name values are static within historian points and source names.

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Historian points and source names do not reflect any changes you make to an asset name.

Token	Description
`{name}`	Asset name
`{path}`	Asset path including all parent assets
`{feat}`	Feature or spectral band name
`{unit}`	Units of the feature or spectral band

You can replace the names of features and spectral bands in the InsightCM Server with custom names.

Now that you have created a new point name pattern, add point mappings for equipment assets (page 141).

Reviewing the Latest Value

Review the latest value of one or more historian points.

1. Click the **Navigation** menu (˅) and select **System > Historian**.
2. Select one or more point mappings.
3. Click the **Action** menu (≡) and select **Get Point Values**.

You can query the historian software. Refer to Querying the Historian Software (page 144) for more information.

A value of Pt Created means the point exists on the historian server, but the InsightCM Server has not written a value to it.

Preventing InsightCM from Writing to Historian Points

Prevent the InsightCM Server from writing values to specific historian points on the historian software to avoid storing invalid data from a faulty sensor.

1. Click the **Navigation** menu (˅) and select **System > Historian**.
2. Select one or more point mappings.
3. Click **Edit**.
4. Remove the checkmark from the **Enabled** checkbox.

Querying the Historian Software

Query the historian software to troubleshoot or review historian points that InsightCM wrote to the historian software using point mappings.

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1. Click the Navigation menu (˅) and select **System > Historian**.
2. Click the Action menu (≡) and select **Query Points**.
3. Because the historian software typically returns too much data and causes a timeout error, replace the default query string:

   ```
   tag='Icm*'
   ```

   - If you use OSIsoft PI Server software, refer to the PI SDK Utility Help for more information about query syntax.
   - Queries are limited to 1,000 results.

Exporting Point Mappings

Export information from all pages of the point mappings table to an Excel spreadsheet.

1. Click the Navigation menu (˅) and select **System > Historian**.
2. Click the Action menu (≡).
3. Select **Export Point Mappings Spreadsheet**.

Importing Point Mappings

Change point mapping names and enablement by importing an Excel (`.xslx`) spreadsheet with the correct information.

> You can update only the point mapping names and point enablement by importing a point mappings spreadsheet.

1. Click the Navigation menu (˅) and select **System > Historian**.
2. On the right, click Action menu (≡).
3. Select **Export Point Mappings Spreadsheet**.

   You download an Excel spreadsheet with information for every point mapping.
4. Edit the outdated point mappings in the Excel spreadsheet.
5. Save the spreadsheet and return to InsightCM.
6. On the right, click Action menu (≡).
7. Select **Import Point Mappings Spreadsheet**.
8. Select the document you saved and click **OK**.

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Adding a New Point Name Pattern

Add a new point name pattern to make the name of InsightCM data points match the name of historian points in your historian software.

1. Click the Navigation menu (˅) and select **System > Historian**.
2. On the **Point Mappings** tab, click **Add**.
3. Enter static text and tokens you want the web application to replace with dynamic information about the tag.
4. Select the asset type you want to apply the pattern to.

> Verify that the web application successfully applied point name patterns by checking the historian point names on the **Point Mappings** tab.

List of Tokens that Insert Dynamic Information in Point Names

Use tokens as you configure InsightCM's data point naming conventions to match your OSIsoft PI system.

The following list contains tokens you can include in point name patterns.

> Surround each token with curly braces, as shown below.

> Asset name values are static within PI point and source names. If you change the name of an asset, PI point and source names do not reflect the change.

Token	Description
`{name}`	Asset name
`{path}`	Asset path including all parent assets
`{feat}`	Feature or spectral band name[1]
`{unit}`	Units of the feature or spectral band

[1]You can replace the names of features and spectral bands in the InsightCM Server with custom names.

Refer to Point Name Patterns (page 146) and Defining Custom Feature Names (page 147) for examples of using these tokens.

Point Name Patterns

You must activate InsightCM Enterprise Gateway to use point mappings.

To ensure that point names follow a uniform pattern and contain minimal errors, define patterns that create and insert static characters and dynamic information into point names. For example,

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a point name pattern of `Location_{path}_{unit}` results in a point name that looks similar to `Location_NorthSite_Motor_AccelerometerX_RMS_g`.

> The default point name pattern is the `{path}` token.

Defining Custom Feature Names

Define custom names to replace default feature names in point mappings. InsightCM inserts the custom names when you apply a point name pattern that contains the `{feat}` token.

1. Click the Navigation menu (˅) and select **System > Historian**.
2. Use one of the following methods to define custom names to replace the default names of features.

Customize a feature name.	1. Switch to the **Point Name Patterns** tab. 2. Select a feature. 3. Click **Edit** and enter the `{feat}` token in the **Pattern** field. 4. Click **OK**. 5. If applicable, select the **Point Mappings** tab and re-add the affected assets to apply changes to existing mappings. > The list contains entries for features that InsightCM supports.
Insert feature names to point mappings.	1. On the Point Mappings tab, click **Add** or select an existing point mapping and click **Edit** to add or to edit a point name. 2. Enter the `{feat}` token in the point name pattern. 3. Click **OK**.

6.1.8.3. Interfacing with OPC UA Historians

Connect to the built-in OPC UA Server using InsightCM.

Before you begin, open port 49580. Refer to Opening Required Ports for Communication (page 128) to learn how to open ports.

InsightCM automatically writes new feature values to pre-defined channels in the built-in OPC UA server. These channels are not customizable.

1. Launch Windows Services.
2. Select the InsightCM <version> entry in the list of services.
3. Click **Restart**.

> Restart the InsightCM software to integrate a data historian.

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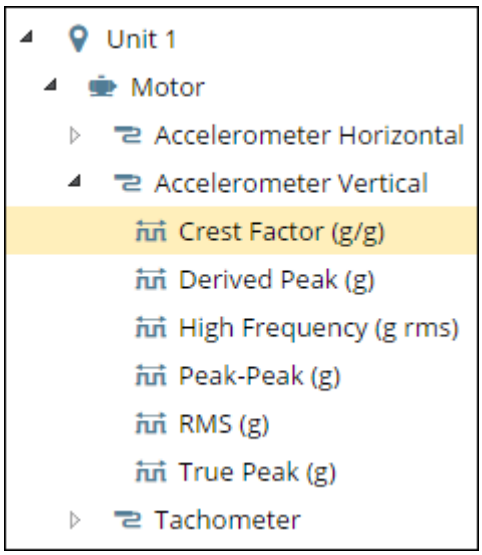
4. Launch InsightCM.
5. Click the Navigation menu (˅) and select **Options** > **OPC**.
6. Select the **Configure OPC** checkbox.
7. Configure the OPC UA server properties and policies as needed.
8. Click **OK**.

Names of Items on the OPC UA Server

The InsightCM Server automatically writes all trend points to the OPC UA server installed with the InsightCM Server. The names that InsightCM Server assigns to these items in the OPC UA server follow a predefined scheme, and you cannot customize them. To query the OPC server for the values of tags, you must use the following naming scheme.

OPC Tag Naming Scheme

The OPC tag naming scheme follows the same format as the asset path. For example, consider the InsightCM Server tag for crest factor in the following asset tree:

Asset Tree:	
Asset Path:	`Unit 1|Motor|Accelerometer Vertical|Crest Factor`

The InsightCM Server replaces the vertical bars with periods (.) when it creates and interacts with items in the OPC UA server, but otherwise maintains the same name, as shown below.

Item Name:	`Unit 1.Motor.Accelerometer Vertical.Crest Factor`

Securing the OPC UA Server

To authenticate or secure communication between the OPC UA client and the InsightCM OPC UA server, configure and exchange certificates.

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1. Using your OPC UA client, generate an OPC UA client certificate.
2. Launch InsightCM, expand the Navigation menu (˅) and select **Options**.
3. Navigate to **Server Settings** > **OPC**.
4. Enable the **Configure OPC** checkbox and configure the options that appear. If you select **None** in the **Supported Security Policies** section, you do not need to generate a client certificate.
5. Copy the certificate you created in step one to the location specified in the **Client Certificate File Path** field.
6. Click **OK**.
7. When InsightCM prompts you to restart services, click **OK**.
8. Copy the server certificate to your OPC UA client.

Refer to the documentation for your OPC UA client for more information on how to copy the server certificate to the OPC UA client. By default, the server certificate is located at `C:\ProgramData\National Instruments\certstore\opcua\NI InsightCM OPC Server Certificate.der`.

6.1.8.4. Notifications Page

InsightCM aggregates and lists daily error and alarm notifications on the Notifications page.

1. Click the Navigation menu (˅) and select **Notifications**.
2. View the notification summary for a date within a seven day range.
   a. Click the **History** button to display the **Select Report Date** dialog box.
   b. Choose which report to display.
3. Change the parameters of a notification.
   a. Select a notification.
   b. Click **Edit** to change parameters such as the time range or number of transitions covered by the notification.

   > Editing is not available for all notifications and the parameters available for editing vary for each notification.

4. Export a notification report spreadsheet to your computer.
   a. Click the **History** button to choose the date for which you want to save a report.
   b. Click **OK**.
   c. Click **Export**.

6.1.8.5. OPC UA Data Source Properties

The OPC UA data source supports configurable properties that affect how the device communicates with the OPC device.

OPC UA properties are available only after you add an OPC UA data source (page 147).

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Property Name	Description
Server Endpoint URL	The OPC UA server URL.
Interval (sec)	How often the InsightCM device process reads the device, in seconds.
Read Timeout (sec)	How long the read process waits for a response from the OPC server when the client is reading from the server. If the OPC UA server does not respond within the specified timeout, the InsightCM device attempts to re-open a connection after 30 seconds.

When you specify the file names for your server and client certificates, ensure that all certificate files are in the following directory.

`C:\ProgramData\Cutsforth\InsightCM\Auth\eDNAConfig.json`

6.1.8.6. Historian Data Source Property

The Historian data source supports properties that affect how the device communicates with the historian software.

Property Name	Description
Interval (sec)	How often the InsightCM device process reads the device, in seconds.

6.1.9. Configuring Your Server Fleet

Configure your server fleet by modifying the .json file that installed to your server with InsightCM.

1. Open File Explorer and navigate to the following location:
   `C:\ProgramData\Cutsforth\InsightCM\Fleet`
2. Find the Example.json file and create a copy of the file for each additional InsightCM server that you want to add to your fleet.
3. Rename each file with a descriptive name and modify each line category according to information for each server you are adding to your fleet.
   - ```
     "Name" : "Example",
     "Host": "localhost",
     "User": "Messagebusconfiguration.json>Username",
     "Password": "Messagebusconfiguration.json>Password",
     "Port": 82
     ```

     The username and password for each server you add to your fleet is located in the `C:\ProgramData\Cutsforth\InsightCM\MessageBusConfiguration.json` file on that server.
4. Once you have created and modified a copy of the `Example.json` file for each server, restart the service and log into the web application.

A new Fleet tab appears on your main dashboard.

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     ```

6.1.10. Defining a Transceiver

Identify the server machine so your devices can locate the server.

Complete the following steps to configure the device transceiver settings so that the device can reliably communicate with InsightCM Server.

1. Click the Navigation menu (˅) and select **Options**.
2. Navigate to the Server Settings section and select **Transceiver**.
3. Click **Alternate IP Addresses** to view all possible addresses for your server.
4. Determine what to use as your hostname.

Static IP address	If your server has a static IP address or you don't expect your server IP address to change, copy the IP address to use as the hostname.
Fully qualified server name	If you are using a DNS server on your network and you expect your server IP address to change, copy the fully qualified server name to use as the hostname. The server name dynamically links to the server IP address even if the IP address changes. However, using the server name is less reliable than using the IP address. Only use this option in cases where using the IP address is impractical.

5. Paste the address or name into the **Hostname** field.
6. Uncheck the **Use IP Address** checkbox if you want the transceiver to use the address that you specified in the **Hostname** field rather than the default IP address. When you save the server settings, the Transceiver value automatically updates to match the Hostname value.
7. Click **OK** to restart InsightCM Server and apply the change.

After you save the new server settings, reset the device connection to get the device to send the updated connection information files to the server.

6.2. Maintaining InsightCM

Optimize your system by managing packages and configuring an aging strategy for data.

Before you begin, ensure that you have added Cutsforth monitoring devices (page 31), mapping, and have acquired data (page 41).

Complete the following tasks to manage application packages and to conserve disk space.

1. Manage Packages (page 151)–Upload and download software packages, which this page refers to as system images or firmware.
2. Configure an Aging Strategy (page 153)–Conserve disk space by configuring a strategy that automatically deletes historical data when certain conditions are met.

6.2.1. Managing Packages

Upload and download software packages, which this page refers to as system images or firmware.

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The InsightCM Server installs some default software packages. If you create or receive updated or patched packages, use this page to upload it so you can apply the packages to devices.

> You cannot manage packages using Windows 10. Refer to support documentation for more information.

- Click the Navigation menu ( ) and select **Utilities > Package Management**.
- Complete one of the following tasks according to your package management goals.

Update the application that runs on one or more devices.	1. Click **Configuration** ( ) and select **Devices**. 2. Select one or more devices and click **Update Application**. This operation requires devices to reboot and might take several minutes to complete.
Upload a software package to the server.	1. Click **Upload**. 2. Navigate to the package you want to upload to the server. 3. Click **Open** to begin the upload.

6.2.2. Aging Strategies

An aging strategy prompts the server to delete historical data if certain conditions are met.

Systems with many devices or with devices performing frequent acquisitions can require significant disk space to store data. InsightCM provides features for automatically discarding data events after configurable conditions are met. This automatic process, called aging, conserves disk space while maintaining a desirable collection of data.

InsightCM applies the periodic aging strategy to individual data events that are not part of a stream. The streaming aging strategy is used to discard entire streams. InsightCM does not retain partial streams.

After the daily aging strategy runs, InsightCM retains a maximum of one trend point per hour, excluding streams. If a data event contains a data set and a trend point, InsightCM counts that as the trend point for that hour and deletes all other trend points.

> InsightCM ignores periodic data events triggered by an alarm transition and never deletes them due to aging.

6.2.2.1. Calendar-Based Aging Strategy

A *calendar-based strategy* enables you to determine which and how much data to discard. This strategy follows a time-based schedule to discard data events after a configurable number of days. You can configure the strategy to discard all data sets except those collected at a specific time. For example, you can retain some data to trend over an extended period of time by configuring a calendar-based strategy that deletes all periodic data events except those collected at 12:00pm after two days elapse.

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You can also choose to retain data events that have alarms or comments associated with them and exclude data events from a particular operating state.

> The aging strategy runs every fifteen minutes, so InsightCM might not discard data immediately after the aging condition is met.

6.2.2.2. Identifying Data that Is Exempt from Aging

You can identify data that InsightCM exempts from aging on the Trend viewer. The Trend viewer shows data points from times that are exempt from aging rules. For example, if InsightCM is configured to delete all periodic data three days after collecting it, but the Trend viewer displays a value that is five days old, that data point is exempt from aging.

6.2.3. Configuring an Aging Strategy

Conserve disk space by configuring a strategy that automatically deletes historical data when certain conditions are met.

To learn more about the periodic and streaming aging strategies, refer to Aging Strategies. Complete the following steps to configure an aging strategy.

1. Click Navigation menu (⌄) and select **Options**.
2. Navigate to **Server Settings**.
3. Select **Periodic Aging Strategy** or **Streaming Aging Strategy**.

   > Both periodic and stream aging strategies are system-level strategies that apply to data events from all devices.

4. Use the **Aging Strategy** pull-down to select the **Calendar-Based** strategy.
5. Use the text box below the pull-down to specify how many days' worth of data events to retain.
6. Specify time(s) when the device permanently retains the data events it collects.
7. Use the corresponding checkboxes to configure whether data events collected with alarms or for all MCSA Startup events are always retained and whether to retain burst data sets.
8. Use the **Never retain data events from** pull-down and select an operating state.
9. Click **OK**.

The following table compares how two different aging strategies operate on data. In these examples, assume Day 1 begins with zero data events.

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Strategy	Day 1			Day 2			Day 3		
Collect	Delete	Total Stored	Collect	Delete	Total Stored	Collect	Delete	Total Stored	
Calendar-based—Retain from the past two days	3	0	3	3	0	6	4	All 3 collected on Day 1	7
Calendar-based—Retain from the past two days, and then permanently retain the data event collected at 12:00 PM every day	3	0	3	3	0	6	4	All collected on Day 1 except the one collected at 12:00 PM	8

The calendar-based strategy in the second row is useful when you want to access all acquired data only during the recent past. For example, if an equipment asset fails, you may want to review data from every acquisition that occurred 2 days prior to the failure. However, you may only need to view data from one acquisition per day twenty days prior to failure.

Now that you have configured an aging strategy, learn how to preserve some data events from aging strategies (page 154).

6.2.4. Preserving Data from Aging Strategies

Ensure data from a specific acquisition remains available for viewing regardless of aging rules.

Before you begin, you need to have acquired data.

Feature and sensor data remains accessible whenever the Trend viewer time-axis contains the time at which the acquisition occurred. When you choose to retain data, InsightCM retains all the data associated with the sensor acquisition, such as feature values, the time waveform, and other measurements, such as the FFT curve.

Complete the following steps to identify which data events you want to retain.

1. Click the Navigation menu (˅) and select **System > Data Events**.
2. In the **Data Events** dialog, select an equipment asset from the asset tree to bring up corresponding log data events on the right.

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3. Select the data event of interest that contains data sets.
4. Click **Retain**.

> Remove the *retain* property by selecting a data event marked for retention and clicking **Retain**.

5. Click **OK**.
6. Verify that the data event has been marked for retention.

> Click the Action menu (≡) above the data events log and select **Export** to export a TDMS file for a data event.

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7. Troubleshooting

7.1. Logging Important Event Details

A *tracepoint* is a flag that, when enabled, instructs the server to log messages about when particular events occur. For example, the `Storage.MajorOps` tracepoint flags events related to file I/O. Review a dynamic list of tracepoints that update as they become available.

1. Click the **Navigational menu » Utilities » Trace Logger**.
2. (Optional) Double-click a tracepoint in the table to enable or disable a specific tracepoint.
3. (Optional) Create an exception that inverts the status of a tracepoint for a specific device.

   > Exceptions work differently depending on whether the tracepoint is enabled or disabled.
   >
   > - *Enabled tracepoints* - An exception prevents the server from generating messages for the exception item.
   > - *Disabled tracepoints* - An exception allows the server to generate messages for only the exception item.

   a. Select a tracepoint whose name begins with `Device` in the table.

      > Exceptions are valid only for tracepoints whose names begin with Device.

   b. Click the **Edit** button.

   c. Click **Add** and enter the name of the device you want to create an exception for in the text field that appears.

      > Exceptions are case-sensitive.

4. Download logs of a tracepoint or server-crash information as text files.

   a. Click the **Action menu**.

   b. Select **Download Trace Log** or **Download Crash Log**.

7.1.1. Exceptions for Device-Related Tracepoints

Exceptions are useful for storing tracepoint information from a select number of devices instead of all devices.

For example, if you only care about a specific device that is experiencing issues rather than every device in the system, you might disable the Device.SystemEvent.Level1 tracepoint. Additionally, you might create an exception for the one device you are interested in tracking so that the server generates messages for any events that device might have. Exceptions are case-sensitive, so when you add an exception, enter the exact device name.

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7.1.2. Notable Tracepoints

Please note that this is not a complete list of all available tracepoints.

Tracepoint Name	Tracepoint Description	Use Case
Authentication.Srptracing	Reports about operations related to authenticating device credentials.	You are bringing devices online and troubleshooting connection issues.
Provisioning.StateChange	Each time a device tries to connect, reports specific issues related to the device status, such as the software configuration or application being out of date.	
Transceiver.Connections	Reports when devices connect, disconnect, or become authorized to connect to the InsightCM Server.	
Device.FileManager.SendData	Reports when the device sends data events to the server.	See when a device sends data to the server.
DataStorage.MajorOps	Reports general operations for storing data events.	Monitor the server receiving data events from devices.
PIHistorian.TagWritten	Reports whenever InsightCM Server writes a value to the PI software.	You want to monitor activity by historian software.

7.2. Resolving and Clearing an Invalid Configuration

Enable your device to collect data again by changing the collection settings and conditions for an asset. When unresolved errors, such as reaching CPU and/or memory capacity, occur and persist in the device application, the device can enter a state of Invalid Configuration. This state works like an idle state where the application does not respond to any internal or external requests except requests to restart.

Complete one of the following steps to resolve and then clear the invalid configuration state of a device.

1. Click the **Configuration** pull-down and select **Devices**.
2. Double-click the device with the Config Status of Invalid Configuration.
3. Identify which equipment asset sensors are mapped to the device.
4. Click the **Configuration** button to get to the Asset Configuration page.
5. Select the equipment mapped to the device with an Invalid Configuration.
6. In the equipment's configuration panel, select the **Operating States** tab.
7. In Data Set Collection Settings, configure the file length so that it is lower than its current setting.

   You may also free up memory or CPU by lowering the Sample Rate in the device's configuration page and/or removing integrated features from sensor asset properties.

8. Navigate to the **Device Configuration** page in the web application.
9. Select the device that still has a Config Status of Invalid Configuration and select the **Action menu**.

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10. Select **Clear Invalid Configuration** to make the device responsive to requests again.

If your device's application re-enters an Invalid Configuration state due to issues unrelated to memory or CPU, contact technical support.

7.3. Troubleshooting Deployment Issues

Complete the following steps to troubleshoot deployment issues.

1. Expand the navigation menu and select **Utilities » Deployment Status**.
2. Refer to the Action Status column for the failed entry to find the System Configuration API error code associated with that type of failure.

7.4. Troubleshooting Devices That Do Not Come Online

Bring your device(s) online by applying troubleshooting steps for one of several possible causes.

> Wait several minutes for devices to download configurations, update an application, and/or reboot before troubleshooting.

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Status on Device Dashboard	Possible Cause	Troubleshooting Steps
Disabled	The device was manually disabled via the **Action menu** item on the Device Configuration page.	On the Device Configuration page, select the device and then select **Action menu » Enable Device**.
Offline	The device is in the process of rebooting.	Wait several minutes to see if the status changes.
	The device does not have connection information.	1. Select the device and then select **Action menu » Connection » Test Connection**. 2. If the device responds to the ping with a message other than "All tests passed", complete the following steps. a. Wait a few minutes before repeating the test. If the same message recurs, continue to the next step. b. Verify the IP address is correct. c. With the offline device selected, select **Connection » Reset Connection** from the Action menu. d. If the device fails to reset, physically reboot the device using the Reset button on the controller.
	The device is not powered on or not connected to network.	▪ Verify the physical connections to power and the network. ▪ Watch the USER1 LED on the device. This LED blinks in one-second increments to indicate normal operation. ▪ Physically reboot the device using the Reset button on the controller.
Unconfigured	The device IP address is not configured and has never tried to connect to the InsightCM Server.	1. Double-click the device to modify its configuration. 2. Select the **Hardware** tab and then select **Edit Hardware**. 3. Update the IP Address for the device and click **OK**.
Unauthorized	The device does not have credentials that match what the InsightCM Server expects.	1. Select the device and then select **Action menu » Connection » Test Connection**. 2. If the device responds to the ping with a message other than "All tests passed", complete the following steps. a. Wait several minutes before repeating the test. If the same message recurs, continue to the next step. b. Verify that the device IP address in the web application matches the device's current IP address. c. With the offline device selected, select **Connection » Reset Connection** from the Action menu. d. If the device fails to reset, physically reboot the device using the Reset button on the controller.

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Status on Device Dashboard	Possible Cause	Troubleshooting Steps
UpdatingFirmware	The device is in the process of downloading firmware and rebooting.	1. Wait several minutes after the last action you performed in the web application before refreshing it to see if the status changes. 2. Change the device type if the incorrect value is in the Device Type column by selecting **Action menu » Change Device Type**.
UpdatingConfiguration	You saved the device configuration, or changes to the server triggered the InsightCM Server to update the configuration on the device.	Wait at least five minutes after the last action you perform in the web application to see if the status changes.

7.4.1. Logging Information about the Connection Process

Enable the following tracepoints on the **System page >Trace Logger** tab to log events that occur specifically during the provisioning process.

> Refer to the help documentation for the Logging Important Event Details (page 156) topic for more information about enabling tracepoints and accessing the logs they produce.

Tracepoint Name	Tracepoint Description
Provisioning.StateChange	Reports changes in the status of a device, such as when the software configuration or application is out of date.
Device.SystemEvent.Level1	Reports about device operations, such as acquisition triggers that fire and their cause. This point is not available until the first device connects to the InsightCM Server.
Authentication.Srptracing	Reports about operations related to authenticating device credentials.
Transceiver.Connections	Reports when devices connect, disconnect, or become authorized to connect to the InsightCM Server.

7.5. Troubleshooting the Connection between the Server and a Device

Determine why the server and a device are not connecting and establish/restore the connection.

The **Test Connection** dialog box checks common issues that prevent a device from connecting to the InsightCM Server and coming online.

1. Check for common issues by testing the connection between the server and the device.

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a. Select the pull-down by **Configuration » Devices**.

b. Select **Action menu » Connection » Test Connection**.

2. (Optional) If the test results in All tests passed, you may need to deploy a supported application to the device before it will come online.

> The device may be formatted correctly, but not yet running a supported application.

a. Select the pull-down by **Configuration » Devices**.

b. Click the **Software** tab and select the device.

c. Click **Update Application**.

7.6. Troubleshooting Email Delivery

Debug possible reasons email delivery fails using tracepoints.

Refer to the Setting Up Email Alarm Notifications topic for steps to configure settings for an SMTP server.

If the InsightCM Server fails to send alarm notification emails, complete the following steps to log information about the failure.

1. Click the Navigation menu (˅) and select **Utilities >> Trace Logger**.
2. Double-click the **SMTP.Emails** tracepoint to enable it.
3. Click the Navigation menu (˅) and select **Options**.
4. In the tree on the left, select **SMTP**.
5. Select **Test Mode**.

> Test Mode prevents the server from sending emails, even when you run commands from the InsightCM console. Enable the SMTP.Emails tracepoint to view messages that the server writes to the trace log.

6. Trigger an alarm that sends an email notification.

   The server attempts to send an email to that address group and logs information about the attempt in the trace log.

7. Return to the **Trace Logger** tab and select the **Action** menu (≡) and **Download Trace Log**.
8. Open the log file with a text editor and search for the tracepoints labeled `SMTP.Emails` for email delivery information.

7.7. Error Values for Integrated Features

Symptoms of Issue

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- Features appear in the web application with incorrect values (by default, -1), which indicates an error occurred.
- The features are for a measurement type derived by single or double integration. For example, features calculated from velocity data that you derive from acceleration data via single integration.

Possible Cause

The time-domain data from which the InsightCM Server calculates the features might not be of a sufficient duration. To calculate features from integrated data, the InsightCM Server requires enough time-domain data to allow for filter settling time.

7.7.1. Common Causes of This Issue

As mentioned previously, this issue occurs only when single or double integration is enabled for a channel. Also, the issue often occurs in data acquired as part of a run-up or coast-down stream because those acquisitions can be very short. For example, consider a device configured to perform stream acquisitions with a length of 10 revolutions. For fast-moving equipment, the revolutions might occur in a very short amount of time, meaning the resulting waveforms do not contain enough data for InsightCM Server to calculate feature values.

This issue can still occur even if you ensure that acquisitions always last at least one second. For example, consider an accelerometer channel with single integration enabled in order to perform velocity measurements. If features calculated from the acceleration data are valid but velocity features have error values, the cause might be that the velocity time-domain data is too short. This occurs because of the way the InsightCM Server filters integrated time-domain data.

7.7.2. How Filtering Affects the Duration of Integrated Data

To account for integration settling time, InsightCM discards the first *n* seconds of the integrated time-domain data before calculating features from it, where the following equation determines the value of *n*.

$n = (1 / \texttt{Integration Cutoff}) * x$

As the following table explains, the value of Integration Cutoff and x vary according to whether the InsightCM Server performs single or double integration.

Type of Integration	Source of Integration Cutoff Value [1]	Value of x Constant
Single	**Single Integration Cutoff** property	3
Double	**Double Integration Cutoff** property	10
[1]Set these properties for each channel on the Device Configuration page»Channels tab»Properties tab.		

7.7.3. Working Around This Issue

To avoid situations where integrated time-domain data is too short, set the acquisition duration to be a number of seconds such that the waveform is at least one second longer than the integration filter settling time.

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Also, if you change the value of the **Single Integration Cutoff** or **Double Integration Cutoff** property for a channel, ensure the new value does not cause the integration settling time to become too long.

7.8. Replacing a Device in InsightCM

Bring replacement devices online in InsightCM.

Ensure that you have another device to replace your original device.

Complete the following steps to replace a device in the web application as you do so in person.

1. Click the **Configuration pull-down** and select **Devices**.
2. Click the **Action** menu and select **Disable Device**.

   > Disabling the device prevents it from attempting to communicate with the InsightCM while you are replacing it.

3. Power off the old device.
4. Set the IP address of the new device to be the same as the device you are replacing.

   This allows the new device to connect to InsightCM and come online when it powers on.
5. Mount the new device in place of the old device, connecting to the network, sensors, and power.
6. In the web application, on the Device Configuration page, click the **Action** menu and select **Connection » Test Connection**.

   This prompts the device to connect to InsightCM.
7. Click the **Action menu » Connection » Reset Connection** to send a new connection information file to the device.

   The connection file includes new credentials so that the device can come online.
8. Check the device status on the Device Configuration page to ensure it comes online.
9. If the model of the new device is different from the old module, update the device configuration.

7.9. Testing Sensors to Validate Hardware

Test sensor asset connections in the Test Panel page.

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Task	Action
Viewing feature values for every asset on a device.	Browse to any device-related page, such as the Devices page or a Device Dashboard page, and then select Test Panel from the View menu.
	Click the Feature Chart tab and select an asset from the pull-down menu in the top-left of the tab.
Configuring the feature trends tab	Browse to any device-related page, such as the Devices page or a Device Dashboard page, and then select Test Panel from the View menu.
	Click the Feature Trend tab.
	Expand the Select Data Group pull-down menu and select a data group.
	Click Select Trends and use the resulting dialog box to manage what trends appear in the graph.
	(Optional) Click the Set Scale button, remove the checkmark from Auto-scale, and enter the minimum and maximum axis values.
Displaying the trend of feature values	Browse to any device-related page, such as the Devices page or a Device Dashboard page, and then select Test Panel from the View menu.
	Click the Feature Trend tab and select a data group to view feature values for in the pull-down menu in the top-left of the tab.
Viewing live domain data	Browse to any device-related page for an EMSA device, such as the Devices page or a Device Dashboard page, and then select Test Panel from the View menu.
	Click the Time Domain tab and configure the options in the left side of the tab. Viewing live data on the Time Domain tab pauses the current spectrum sweep. The sweep resumes when you pause the live data view again.
Recording live domain data	Browse to any device-related page for an EMSA device, such as the Devices page or a Device Dashboard page, and then select Test Panel from the View menu.
	Click the Audio tab and configure the options in the left side of the tab. Recording live time domain data on the Audio tab pauses the current spectrum sweep. The sweep resumes when the recording finishes.

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